

XMM-Newton

XMM-Newton Proposers' Guide and Remote Proposal Submission Software Users' Manual

XMM-PS-GM-17

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1 Glossary

For more information on frequently used technical terms, see also the **XMM-Newton** Glossary.

Acronym	Explanation
AO	Announcement of Opportunity (AO-6)
AMS	Archive Management Subsystem
<i>Chandra</i>	Chandra X-ray Observatory (AXAF)
CCD	Charge Coupled Device
Co-I	Co-Investigator
DEC	Declination, δ (J2000)
EPIC	European Photon Imaging Camera
ESOC	European Space Operations Centre
ESTEC	European Space Research and Technology Centre
FAQ	Frequently Asked Question
FITS	Flexible Image Transport System
FOV	Field Of View
FWHM	Full Width at Half Maximum
GO	Guest Observer
GSFC	Goddard Space Flight Center
GT(O)	Guaranteed Time (Observer)
GUI	Graphical User Interface
HEASARC	(NASA) High Energy Astrophysics Science Archive Research Center
HEW	Half Energy Width
LSF	Line-Spread Function
MOC	XMM-Newton Mission Operation Centre
MOS	Metal Oxide Semi-conductor
ODF	Observation Data File
OM	Optical Monitor
OTAC	Observatory Time Allocation Committee
QLA	Quick Look Analysis (software)
PHS	Proposal Handling Subsystem
PI	Principal Investigator
PIMMS	Portable, Interactive Multi-Mission Simulator
PSF	Point-Spread Function
PV	Performance Verification
RA	Right Ascension, α (J2000)
RFC	RGS Focal Camera
RFS	Refreshed Frame Store mode of EPIC MOS
RGA	Reflection Grating Assembly (of the RGS)
RGS	Reflection Grating Spectrometer
SAS	Science Analysis Subsystem
SOC	XMM-Newton Science Operations Centre

SSC	Survey Science Centre
TBC	To Be Confirmed
TBD	To Be Determined
TOC	Table of Contents
ToO	Target of Opportunity
UHB	XMM-Newton Users' Handbook
URL	Unique Resource Location
USG	XMM-Newton User Support Group
<i>W</i> 90	90% Energy Width
WWW	World Wide Web
XMM-Newton	X-ray Multi-Mirror Mission
XRPS	XMM-Newton Remote Proposal Submission software

2 Introduction

The **XMM-Newton** Remote Proposal Submission software (XRPS) has been developed for ESA (ESOC), under contract, by Logica UK Limited. It is an online proposal submission software package, which is accessible via the URL <http://xmmrps.vilspa.esa.es/>. The software is not downloadable and cannot be used off-line. All **XMM-Newton** proposals must be submitted remotely via XRPS.

Because of the potential high load on the system close to the deadline of AO-6, the **XMM-Newton** SOC strongly encourages **XMM-Newton** proposers to **submit proposals well before the deadline**. Details on the Call for **XMM-Newton** Proposals can be found in the SOC's AO-6 documentation.

BEFORE submitting an **XMM-Newton** proposal, please read this document carefully and consult also the **XMM-Newton** Users' Handbook (UHB). The **XMM-Newton** Users' Handbook can be found via the URL http://xmm.esac.esa.int/external/xmm_user_support/documentation/index.shtml, where users can choose between HTML, PS and PDF versions of the document.

2.1 Scope of this document

This document is the aide to guide users through the **XMM-Newton** proposal submission process with XRPS. Users should follow the steps outlined here closely.

The XRPS Users' Manual is available in three different formats:

HTML online at

http://xmm.esac.esa.int/external/xmm_user_support/documentation/rpsman/index.html

PostScript (PS) at

<ftp://xmm.esac.esa.int/pub/A06/RPSMAN.ps.gz>

Portable Data Format (PDF) at

<ftp://xmm.esac.esa.int/pub/A06/RPSMAN.pdf>

The **XMM-Newton** SOC advises users to use the online version whenever possible to take advantage of the hyperlinks in the text of this document to the appropriate sections of the UHB and also because it might be useful to have this Users' Manual available in one viewer while making the XRPS entries in a separate viewer session.

2.2 Document structure

This Users' Manual (UM) first suggests a straightforward way to plan **XMM-Newton** science observations (§ 3). Then it provides general information on XRPS (§ 4). This is followed by a detailed, step-by-step, guide on how to submit an **XMM-Newton** proposal (§ 5). § 5 follows very tightly the order in which inputs into the XRPS form sheets should be made (because the order, in particular at the level of individual OM exposures within an observation, can be important). § 7 is just a brief note on the implications of SOC proposal enhancement requests. § 8 outlines how to obtain information on **XMM-Newton** Targets of Opportunity. § 9 contains a caveat about the expected XRPS performance close to the deadline. Finally, § 10 lists XRPS-related documents and other information and in Appendix A some examples are given.

At many points where users might need information on which entries to make (for example from the UHB), hyperlinks are provided to the location of that information. Users can then always use the “back” button of their viewer to return to this UM when finished reading the background information. This document is thereby embedded in the SOC web server.

2.3 XMM-Newton help and feedback

If lost, or in case of doubt, please collect information to describe your problem in detail and direct questions and requests for help on XRPS to the **XMM-Newton** Helpdesk. Feedback, i.e., suggestions and/or criticism, should also be sent to the **XMM-Newton** Helpdesk. For details on **XMM-Newton** Helpdesk services and mailing lists, please consult the **XMM-Newton** Helpdesk web page, at the URL http://xmm.esac.esa.int/external/xmm_user_support/helpdesk.shtml.

3 Before entering XRPS

Before entering XRPS, users should first assess the technical feasibility of the intended observations, based on the available information (primarily the UHB) and tools from the SOC web server at the URL <http://xmm.esac.esa.int/>.

Please, consult also the Policies and Procedures for AO-6 under <ftp://xmm.esac.esa.int/pub/A06/A06.Policies.Procedures.pdf> for details about proposal submission.

3.1 Planning an XMM-Newton observation

The Principal Investigator (PI) of an **XMM-Newton** proposal must be aware of those issues which irretrievably corrupt the data taken in-orbit and transmitted to ground and must plan & prepare their observations accordingly. Corruption of scientific results can, e.g., take the form of:

- confusion, or mixing, of the source photons with those from another source in or near the field of view,
- corruption of the reported energy data due to piling-up of more than one photon per pixel per CCD readout frame or due to excessive optical loading of the X-ray CCDs,
- loss of information due to pile-up effects, or due to saturation of telemetry rates,
- loss of calibration accuracy due to photons lost at CCD chip edges.

Generally, the observer needs only to consider the target of interest from the point of view of a simple matrix of properties, namely is the source bright or faint, is one interested primarily in spatial, spectral or temporal information and whether the target is extended or point-like.

For each type of **XMM-Newton** instrument (EPIC, RGS, OM) the user must consider the optimal choice of instrument setup to maximise the scientific return of the observation. General preparatory steps to be taken are:

1. as a minimum, calculate the expected count rates using the information contained in the UHB or the PIMMS (Portable Interactive Multi-Mission Simulator) software from the Goddard Space Flight Center, at the URL <http://heasarc.gsfc.nasa.gov/Tools/w3pimms.html>,
2. using the catalogue interface of SciSim and other catalogues, determine the brightest optical object in the field of view; if any source beyond the OM brightness limit should be in its field of view (FOV), no OM exposures should be defined.
3. using the catalogue interface of SciSim and other catalogues, determine the presence of nearby X-ray bright objects which may cause straylight degradation and

4. using the **XMM-Newton** Target Visibility Tool, determine the maximum duration of continuous visibility available in any orbit.

If the planned observations depend very critically on one of the above parameters and the level of accuracy provided by the existing **XMM-Newton** online documentation is not sufficient to show whether the observations would be feasible, observers should consider performing a detailed simulation with the **XMM-Newton** Science Simulator (SciSim) to produce data in a format similar to that of in-flight data. The simulated data can then be ingested by the SAS software packages, and downstream scientific products can be analyzed with specialized tools for X-ray astronomy data analysis (e.g.: FTOOLS, XANADU etc.). SciSim is available via the URL

<http://xmm.esac.esa.int/scisim/scisim.html>.

We will now describe — in the form of checklists — which aspects of an **XMM-Newton** observation must be considered when planning an observation for different kinds of targets. Appendix A contains examples for the possible choices for some crucial input parameters, depending on the target properties. An example for how to prepare the XRPS form sheets based on such considerations and parameter choices is presented in § 3.2.

3.1.1 General considerations

1. Choice of prime instrument

Users must first decide which is the main science goal and with which of the **XMM-Newton** science instruments this goal can be best achieved.

2. Science mode of prime instrument

Next, the best-suited instrument mode with which to conduct the observations, depending on the target properties, must be chosen. More on this will follow in § 3.1.2, immediately below.

3. Integration time

Then it must be decided how much integration time is needed for the prime instrument, operated in the selected mode, to achieve the science goals.

4. Pointing direction

For extended targets the optimal pointing direction (which might not coincide with the catalogued target coordinates) must be chosen. The pointing should be chosen in such a way that the target is optimally located on the detector of the prime instrument. Thus, if there is a certain region, e.g., in an extended target that is of particular interest, the coordinates of that particular point should be chosen as the boresight coordinates.

5. Avoidance of nearby sources

XMM-Newton science data (both X-ray and optical/UV) can be contaminated by radiation from nearby sources. In case such exists and must be avoided, this might, e.g., lead to position angle constraints on the observations (for example in order to prevent spectral overlaps).

Users must check for the presence of bright optical/UV sources in the OM FOV. In case a source violates the OM brightness limits, which are listed in

UHB Table 23, OM can not be used for observing the target, this time will be used for calibration observations with Filter = BLOCKED.

6. Observations and exposures

An **XMM-Newton** proposal can consist of **up to 50** observations. An “observation” is defined as a pointing to one particular position on the sky, including all sub-units of the observations, which are called “exposures”. For example, a second pointing towards a slightly offset position compared to the first observation (because, e.g., the target does not fit into the EPIC field of view) is a second, independent observation. Pointing towards a new target or position is, by definition, always a new observation, because **XMM-Newton** has no capability to perform raster scans.

3.1.2 Instrument setup

3.1.2.1 For a faint extended source

7. Possible adjustment of optimal pointing position

If it is important to ensure that any particular part of the extended object does not fall on a CCD gap, users must choose the pointing direction appropriately (see UHB sections on EPIC pn chip array, EPIC MOS chip array and Position Angle (PA) constraints).

8. Science mode of all instruments

For each of MOS and pn, it must be decided if any part of the source is bright enough to cause local photon pile-up that would degrade the calibration beyond the science goals when using the “Full Frame” imaging mode (see UHB section on EPIC pile-up). If not, the “Full Frame” mode should be used.

RGS data of faint extended sources are compromised by low total count numbers and a reduced energy resolution. RGS should be used in the normal “Spectroscopy” mode for serendipitous background information if less than 70 counts per second are expected (see UHB section on RGS modes).

For a source that is faint and very extended also in the optical the OM should be best operated in its “Full Frame Low res.” mode (see more about OM modes in § 5.2.4.5).

9. Length of observation

If the observation is long compared with the visibility window (as reported by the online **XMM-Newton** Target Visibility Tool), the user must consider how best to split it up, e.g., into multiple observations that fit into continuous visibility periods.

10. Selection of EPIC optical blocking filter

Users must check the visible magnitude of in-field or nearby optical targets. If the soft X-ray response is important, one should choose the thinnest filter compatible with the brightest visible objects, as described in the UHB section on EPIC filters.

11. RGS readout sequence

For standard “Spectroscopy” mode observations with RGS a standard readout sequence is proposed which can be modified according to the needs of the user (see UHB section 3.4.5 on RGS modes).

12. Choice of OM filter sequence

For the OM it must be decided if specific filter coverage is necessary for the science or if the recommended filter sequence is adequate (see UHB section on OM modes and OM optical elements).

13. Length of exposures

While no limits are expected on the exposure length for the X-ray instruments observing faint sources (except for visibility constraints and the length of the observation), OM exposures are further constrained by telemetry and memory capacity limits (§ 5.2.4.5).

3.1.2.2 For a bright extended source

7. Possible adjustment of optimal pointing position

If it is important to ensure that any particular part of the extended object does not fall on a CCD gap, users must choose the pointing direction appropriately (see UHB sections on EPIC pn chip array, EPIC MOS chip array and Position Angle (PA) constraints).

8. Science mode of all instruments

For each of MOS and pn, it must be decided if any part of the source is bright enough to give rise to local photon pile-up that would degrade the calibration beyond that demanded by the science goals, when using the “Full Frame” imaging mode (see UHB section on EPIC pile-up). In the case of a bright extended source, pile-up might be a concern. Then the user must decide whether “Full Frame” imaging with pile-up in the brightest parts should be performed or partial frame imaging to avoid pile-up, at the loss of imaging data over part of the extended object.

Even for bright sources, in particular when extended, photon pile-up should not be a problem in RGS observations. Therefore, in most cases it should be possible to leave RGS in the normal “Spectroscopy” mode (see UHB section 3.4.5 on RGS modes).

The mode for observing OM will depend on its optical characteristics, please refer to section § 5.2.4.5.

9. Length of observation

If the observation is long compared with the visibility window (as reported by the online **XMM-Newton** Target Visibility Tool), the user must consider how best to split it up, e.g., into multiple observations that fit into continuous visibility periods.

10. Selection of EPIC optical blocking filter

Users must check the visible magnitude of in-field or nearby optical targets. If the soft X-ray response is important, one should choose the thinnest filter compatible with the brightest visible objects, as described in the UHB section on EPIC filters.

11. RGS readout sequence

For standard “Spectroscopy” mode observations with RGS a standard readout sequence is proposed which can be modified according to the needs of the user. In case of particularly strong emission lines, observers might want to read out individual CCDs more often than others (see § 5.2.4.4).

12. Choice of OM filter sequence

For the OM it must be decided if specific filter coverage is necessary to achieve the science or if the recommended filter sequence is adequate (see UHB section on OM modes).

13. Length of exposures

While no limits are expected on the exposure length for the X-ray instruments observing bright extended sources (except for visibility constraints and the length of the observation), OM exposures are further constrained by telemetry and memory capacity limits (§ 5.2.4.5).

3.1.2.3 For a bright point source

7. Science mode of all instruments

For each of MOS and pn, it must be decided if the source is bright enough to give rise to photon pile-up that would degrade the calibration beyond that demanded by the science goals when using the “Full Frame” imaging mode (see UHB section on EPIC pile-up). In the case of a bright point source, pile-up is likely to be a concern. Then the user should choose the partial window mode with the largest FOV that minimises pile-up or, for the very brightest sources, use the “Timing” mode.

In order to assess possible pile-up in individual emission lines in RGS data of bright targets, SciSim should be used for modeling the source spectrum; in case photon pile-up is not a problem, the RGS should (for standard spectroscopy) be left in the normal “Spectroscopy” mode. If a high (> 70 counts/s) count rate is expected, the “Spectroscopy HCR” (HCR = High Count Rate) mode should be used (see UHB section 3.4.5 on RGS modes).

For a optically bright point source the user might consider using the OM’s “Image Fast” mode, if high time-resolution photometry is required. For each of the science instruments, there is one “Image Fast” mode configuration, corresponding to the instrument being prime.

8. Length of observation

If the observation is long compared with the visibility window (as reported by the online **XMM-Newton** Target Visibility Tool), the user must consider how best to split it up, e.g., into multiple observations that fit into continuous visibility periods.

9. Selection of EPIC optical blocking filter

Users must check the visible magnitude of in-field or nearby optical sources and the science target itself. If the soft X-ray response is important, one should choose the thinnest filter compatible with the brightest visible objects, as described in the UHB section on EPIC filters.

10. RGS readout sequence

In case of “Spectroscopy HCR” mode observations of a target with particularly strong emission lines, observers might want to read out individual CCDs more often than others (see § 5.2.4.4).

11. Choice of OM filter sequence

For the OM it must be decided if specific filter coverage is necessary to achieve the science or if the recommended filter sequence is adequate (see UHB section on OM modes).

12. Length of exposures

Telemetry and onboard memory limits place upper and lower boundaries on the duration of single OM exposures as listed in § 5.2.4.5.

3.1.2.4 For timing observations

7. Science mode of all instruments

For EPIC users must check that any neighbouring bright sources are not in the same CCD row/column as the desired object by selecting an appropriate position angle, if necessary, in order to avoid contamination of the target data. For both possible prime science instruments (EPIC and RGS) there is one OM “Image Fast” mode configuration that provides tim series of the central source. The user can also consider using the Science User Defined mode with Image and Fast windows (see § 5.2.4.5).

8. Length of observation

If the observation is long compared with the visibility window (as reported by the online **XMM-Newton** Target Visibility Tool), the user must consider how best to split it up, e.g., into multiple observations that fit into continuous visibility periods.

9. Selection of EPIC optical blocking filter

Users must check the visible magnitude of in-field or nearby optical sources and the science target itself. If the soft X-ray response is important, one should choose the thinnest filter compatible with the brightest visible objects, as described in the UHB section on EPIC filters.

10. RGS readout sequence

If high time resolution is needed for RGS observations it must be decided whether one or all nine CCDs shall be read out (consult the UHB for more details).

11. Choice of OM filter sequence

For the OM it must be decided if specific filter coverage is necessary for the science or if the recommended filter sequence is adequate (see UHB section on OM modes).

12. Length of exposures

Telemetry and onboard memory limits place upper and lower boundaries on the duration of single OM exposures as listed in § 5.2.4.5.

3.2 Preparing an XMM-Newton observation

As described above, preparation of **XMM-Newton** observations starts with a technical feasibility calculation, using primarily the information provided in the **XMM-Newton** Users' Handbook and the tools introduced there.

The scientific goal of the proposal determines the choice of prime science instrument and the total integration time required. It is expected that in all cases either EPIC or RGS will be the most important instrument for the proposed science, i.e., the instrument driving the feasibility calculations. Having determined the total integration time needed for the primary instrument, one must consider in which mode this instrument should be operated and how many exposures (possibly in different modes) should be taken during the intended observation. Then the use of the other instruments, which will be operated in parallel, is planned.

It should not be forgotten that all instrument modes have so-called “overhead” times associated which have to be subtracted from the total observing time. These overheads can take a considerable percentage of the total observing time, particularly for shorter observations, and vary a lot depending on the instrument mode used. A summary of the different overhead times can be found in Table 1. For a detailed description of the different instrument modes see also § 5.2 and the UHB.

The time given by OTAC to a specific proposal does include these overhead times. This means, that a proposal with one granted observation of 10 000 s and e.g. RGS as prime instrument will get effectively only 8 907 s of integration time using the “*Spectroscopy*” mode (see Table 1).

Note, that the overhead times may change slightly throughout the mission, if for some technical reason the activation and deactivation sequences for different instrument modes have to be adjusted.

One of the science goals of **XMM-Newton** is to conduct serendipitous surveys. To achieve this, all **XMM-Newton** science instruments should be operating whenever permitted by applicable constraints (such as, visibility constraints, target brightness, etc.). This implies that **exposures should be defined for each instrument for the entire duration of an observation.**

Table 1: *Overhead times of available instrument modes in seconds for an observation containing only one ($n=1$) exposure. For more exposures the overheads increase according to the formula, substituting n with the number of exposures. Note, that these times may change throughout the mission.*

Instrument	Mode ¹	Obs.start	Obs.end	Exposure	Total Overhead
MOS 1	Full Frame	680	92	$605 \times n$	1327
MOS 1	Large Window	680	92	$600 \times n$	1322
MOS 1	Small Window	680	92	$615 \times n$	1377
MOS 1	Timing	680	92	$870 \times n$	1592
MOS 1	Refresh Frame Store	680	92	$610 \times n$	1332
MOS 2	Full Frame	680	87	$605 \times n$	1322
MOS 2	Large Window	680	87	$600 \times n$	1317
MOS 2	Small Window	680	87	$615 \times n$	1372
MOS 2	Timing	680	87	$870 \times n$	1587
MOS 2	Refresh Frame Store	680	87	$610 \times n$	1327
pn	Full Frame	13	72	$2878 \times n$	2963
pn	Large Window	13	72	$3243 \times n$	3328
pn	Small Window	13	72	$1444 \times n$	1529
pn	Timing	13	72	$2272 \times n$	2357
pn	Burst	13	72	$1712 \times n$	1797
pn	Extended Full Frame	13	72	$5173 \times n$	5258
RGS 1	Spectroscopy	997	17	$80 \times n$	1094
RGS 1	Spectroscopy (HCR)	997	17	$57 \times n$	1071
RGS 2	Spectroscopy	1002	17	$80 \times n$	1099
RGS 2	Spectroscopy (HCR)	1002	17	$57 \times n$	1076
OM	Full Frame High Resolution	1051	34	$8280 \times n$	9365
OM	Full Frame Low Resolution	1051	34	$2909 \times n$	3994
OM	Science User Defined	1338	34	$307 \times n$	1679
OM	EPIC Image	1338	34	$1608 \times n$	2980
OM	EPIC Image Fast	1338	34	$1608 \times n$	2980
OM	RGS Image	1338	34	$1608 \times n$	2980
OM	RGS Image Fast	1338	34	$1608 \times n$	2980

Note to Table 1:

1) For a detailed description of the different instrument modes see § 5.2 or the UHB.

4 General XRPS instructions

The following general advice should be taken into account when using XRPS. It is recommended to read this chapter **before** starting-up XRPS and while using it.

4.1 Recommended browsers and caching setup

The web interface was designed such that most common browsers supporting Java and Javascript should work. However, for best results it is recommended to use the latest versions of Mozilla / Firefox or Explorer.

If caching is enabled on a user's browser, it can happen that pages (like the navigation tool or the results reported to the user from "Check Proposal" ; see below) are not updated correctly. In order to avoid this, the size of both the **disk cache and the memory cache of the browser should be set to 0** while using XRPS.

For details about the best supported versions of browsers and Java, the correct browser settings and reported problems, please look also at the related links on the XRPS entry page:

http://xmmrps.esac.esa.int/phrp/wphrp_rpstips.asp

and

http://xmmrps.esac.esa.int/phrp/wphrp_requirements.asp

and

http://xmmrps.esac.esa.int/wphrp_reports.asp.

4.2 Signing up as an XRPS user

Only users with proposals that passed the *Observatory Time Allocation Committee* (OTAC) successfully can use the XRPS.

Valid **User IDs** and **Passwords** for AO-6 were distributed by email to the corresponding PIs. **To recuperate forgotten or lost User IDs and Passwords, please contact the XMM-Newton Helpdesk via**

xmmhelp@sciops.esa.int

and flag your message as "private".

For all proposal related questions, contact the **XMM-Newton Users Support Group** via

xmmpi@sciops.esa.int.

Entering into XRPS (see Fig. 1) using URL

<http://xmmrps.esac.esa.int/>

you are asked to load your proposal.

This leads you to the next page where you have to enter your user details (see Fig. 2).

Once this is done, press the "Commit" button at the bottom of the page to send your input to an intermediate memory (more details on this will follow in § 4.3).

Some users might want to use more than one User ID (e.g., when preparing a proposal not only for themselves, but also for somebody else). In such a case, it is **NOT** possible to enter XRPS, from one browser window, under a user ID other than the one entered first. In order to enter under a new user ID, the browser session must be exited and a new one started. This is a safety procedure, because XRPS works with cookies to identify the user accessing it via a browser. Once all applications of the session are closed down, the cookie is removed. A new session can then be started with a new cookie, which is then the identifier of the current user ID.

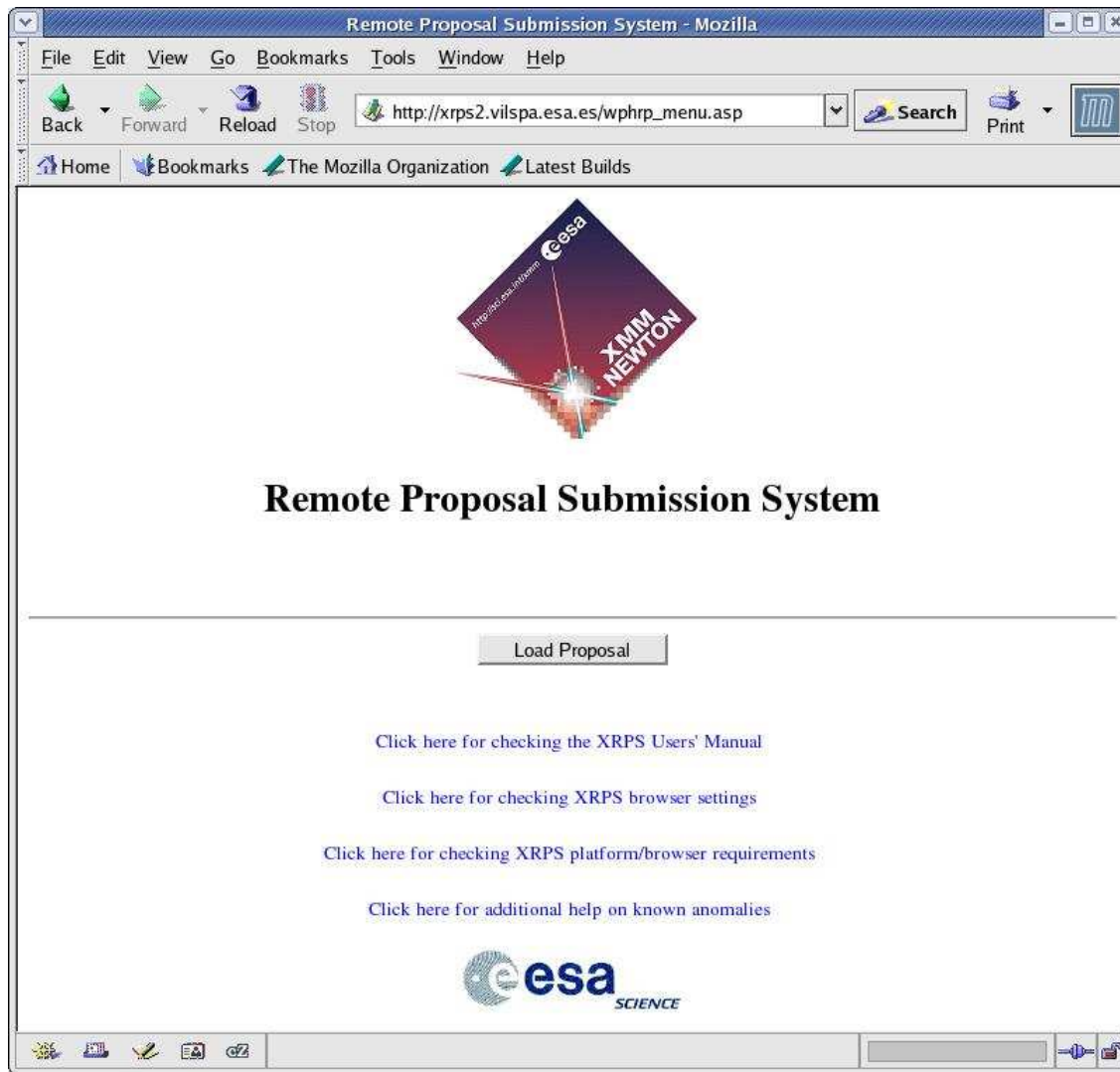


Figure 1: Screen shot of the XRPS home page.

A screenshot of a registration form titled 'Please enter your user details'. The form has a yellow background. It contains two input fields: 'User ID' and 'Password'. Below these fields are two buttons: 'Commit' and 'Return'.

Figure 2: Screen shot of the XRPS page to register as a new user.

4.3 The concept of an intermediate memory

All information that is entered into any of the XRPS web interfaces is, upon pressing the “commit” button, stored in a memory. The commit button is always located at the

bottom of the right frame of the web interface. From this memory entries can be loaded again later, as sketched in Fig. 3. This implies that XRPS users have no access to the proposal database itself.



Figure 3: *Illustration of the concept of an intermediate memory for proposal information that has not yet been submitted into the proposal database.*

The submission procedure is described in § 5.7. A proposal can be submitted **only once** and will disappear from the working area, so that it will not be possible to edit it again in a new browser session at a later time.

Submission will only be acknowledged by email upon receipt of the submitted proposal in the primary database.

If changes need to be made to the proposal after submission, the PI has to contact the **XMM-Newton** Users Support Group via `xmmpi@sciops.esa.int` to enable the proposal again.

4.3.1 Successful memory entries

Successful “committal” of the information contained in a formsheet is acknowledged by a blue message at the top of the screen.

4.3.2 Errors upon committal of entries into memory

Formal input errors and missing mandatory entries will cause XRPS to report an error when trying to “commit” the contents of the page. Error messages are always returned in red at the top of the screen. In case of an error, XRPS exits from the usual frames (see below), until all entries have been made correctly. Then a (blue) success message is returned to the user and XRPS returns to its usual frames layout.

4.3.3 Forgetting to press the commit button

When finished with all entries on one particular form sheet, users **must** press the commit button – this will enter the information into the working memory. **Failure to “commit” information before exiting a page, or just resizing the viewer, will cause loss of all information entered.** Upon loss of input (at least) all mandatory fields (flagged with a red asterisk) must be filled in again. It is also recommended NOT to use the “Back” and “Forward” button of the browser to navigate between the pages.

4.4 The frames of the XRPS web interface

XRPS uses frames to subdivide the viewer window. This frames environment is invoked as soon as a PI has successfully entered his/her personal information and is registered as a user, and is thus ready to enter more details on the planned observations, for which purpose the “Proposal details” page is loaded. As illustrated in Fig. 4, there are in total four frames.

Figure 4: Screen shot of the top-level page containing details about an observing programme: the so-called “Proposal Details” page. This is the first page arranged in the frames setup typical of XRPS forms.

The top frame just displays which software application is used. The other frames are described briefly in the following subsections.

4.4.1 Right centre frame

The right frame of XRPS is the main frame where users type in all entries. Here all the form sheets are displayed which must be filled in. At the top of each page its title is provided for easy identification.

4.4.2 Left centre frame

The left frame of XRPS contains a navigation tool, which in principle consists only of a directory listing, showing all filled-in and committed entry forms, which are stored either as files or directories. The entries in the navigation tool are live hyperlinks, which can be

clicked-on to access a certain page. More information on navigation will follow in § 4.5.

4.4.3 Bottom frame

In the bottom frame a number of click-on buttons are displayed, which have the following functions:

- “Check Proposal”
This button can be used at any time to perform a formal check on the exposure times (including overhead and delay/offset times) for all instruments of all observations in the proposal draft stored in the intermediate memory. Proposals that are returned with formal errors must be corrected before they can be submitted. More details on this option are provided in § 5.3.
- “Postscript Version of Proposal”
This allows the user to create a PS version of the proposal. More details on this option are provided in § 5.5.
- “Technical Evaluation”
This allows the user to check the draft proposal for potential problems with the selected instrument configuration based on the provided source characteristics (e.g. forbidden OM filters because of exceeded brightness limits, pile-up, etc.). More details on this option are provided in § 5.6.
- “Download Help”
The Download Help button offers a hyperlink to this document, the “XRPS Users’ Manual”.
- “Proposal List”
Hyperlink leading back up to the list of proposals of the PI. From there one can also go back up to the XRPS entry page.

4.5 Moving within XRPS

4.5.1 Moving down in XRPS

Movements down to the next lower level are always easy, because special function keys (buttons) are offered at the bottom of the higher-level page (web interface).

A PI can choose one of the proposal drafts from the list left in memory previously by clicking on the proposal title. At the next level, two buttons are offered named “Add Co-I” and “Add Observation”. The “Add Co-I” button is used to enter personal information for each Co-Investigator on the proposal. The “Add Observation” key leads the user to the level where information about the target of a proposed observation is entered.

One level lower, function keys are offered again to “Add Time Details” and “Add EPIC MOS”, “Add EPIC pn”, “Add RGS” and “Add OM”. The first is used to enter time constraints, if any. The latter four allow the user to enter exposures for the different types of **XMM-Newton** science instruments. Note that **there are two EPIC MOS cameras and also two RGS detectors**, for each of which exposures must be defined. This is the

level of input at which the schematic with the pre-planned sequence of exposures within an observation (§ 3.1) comes in handy.

In addition to the above function keys, two more are available at this level, namely “Copy Observation” and “Delete Observation”. The names are self-explanatory.

At the end of each exposure page one also finds the functional buttons to add exposures or to copy/delete the current one. These operations do not lead to a lower level, but create or remove entries at the same (i.e., the exposure) level.

4.5.2 Moving up in XRPS

There are no buttons on low-level pages leading the user back up to a level above. Instead, the entries in the navigation tree in the left-hand frame (Fig. 5) should be used. In case no change is required on a page that has been opened, using the navigation tool on the left-hand side allows users to proceed to another XRPS page.

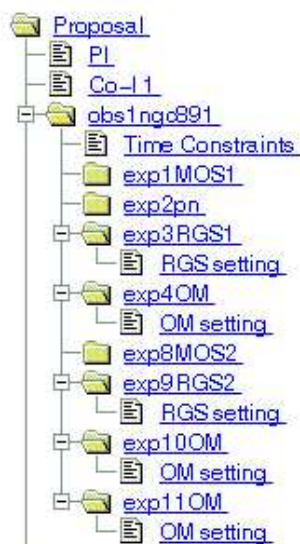


Figure 5: Screen shot of the XRPS navigation tree. Observations are entered as directories carrying the first 8 characters of the object name. Each exposure is identified by a running index within the observation and the name of the instrument with which it is associated. In this example exposures 5, 6 and 7 were deleted again from the list, leaving slot #5, 6 and 7 empty because exposures are not renumbered after a deletion.

Normally, the “back” or “forward” buttons of the viewer should **not** be used to navigate, unless mentioned explicitly as an exception.

Note: Do not forget to “commit” all entries made on the current page before moving on to another!

By using the navigation tool in the left-hand frame, users can move as high up in the hierarchy as the proposal level. In order to return to any higher level (XRPS entry page or list of stored proposals), use the “Proposal List” button in the bottom frame, from where also the XRPS entry page can be reached again.

4.5.3 Arbitrary moves in XRPS

The navigation tool (Fig. 5) allows users to move anywhere, i.e., reload any page that had previously been committed to memory, up to the proposal level. Each entry in the directory tree carries a hyperlink leading to that particular page. To go back higher up, above the proposal level, see instructions above.

4.6 Recommended order of entries

Based on the schematic for an observation suggested in § 3.2 and on the navigation tools provided by XRPS, it is advantageous to insert a proposal by making entries in the following order:

1. First update all details of PI and Co-Investigators.
2. Once completed, start working on the first observation by filling out the Observation page. Time constraints can also be provided at this point, but may also be added later.
3. On the Observation page the above-mentioned (§ 4.5.1) buttons are available to add exposures for the different **XMM-Newton** science instruments.

The SOC **strongly** suggests to follow your observing schematic (§ 3.2) by rows, i.e., fill in first all exposures for one instrument (say, EPIC MOS-1), then the next (EPIC MOS-2 and EPIC pn), followed by those for RGS-1, RGS-2 and OM. For each of the six science instruments, the exposures should best be sorted chronologically. Exposure details, if any, can be added to exposures at any time. This order of making entries is favourable for various reasons:

- Filling in exposures on a by-instrument basis, it is easiest to ensure that each instrument is used during the entire duration of the observation, thus maximising the efficiency of the instrument use.
 - Identifying exposures, when going back to make changes, is easiest when they are sorted first by instrument (Fig. 5).
4. Only after one observation is completely finished, users should start making entries for the next. In case of similar observations (e.g., when observing a sample of objects with similar properties) it is then possible to copy the first observation and reuse the template created this way, just editing (changing) the entries to apply the required adjustments. Adding exposures (at the end of the list) is easy. Deleting unwanted exposures is also possible, using the “Delete Exposure” button.

Note: When deleting observations / exposures, XRPS does not automatically rename all others to fill the resulting gap in the numbering scheme. A new observation / exposure, even if it is meant to fill a gap produced by a deletion, will be appended at the end of the observations / exposure list of a proposal / observation, with a number 1 higher than that of the last observation / exposure in the existing list. Therefore, if an observation / exposure (or the detailed information associated with it) must be changed, it is much better to edit the entries accordingly instead of deleting and replacing it.

The actual order in which different exposures with the same instrument are performed can be controlled with the “Order” parameter (see e.g. § 5.2.4.1).

The following chapter (§ 5) is a step-by-step guide through XRPS; examples are provided in appendix A.

5 Filling in the form sheets – a step-by-step guide

Based on the above general advice the use of XRPS is now illustrated step by step, i.e., page by page and entry by entry.

5.1 XRPS entry page

After logging in with his *User ID* and *Password* each user gets a list of his proposals that passed the *OTAC* successfully. Since AO-3 it is not possible any more to create new proposals with XRPS.

Clicking on the title of one of the proposals in the list brings up the proposal details page of that proposal (see Fig. 4). It contains already some information given by the PI when applying for **XMM-Newton** observation time (e.g. address of PI and Co-Is, proposal title, type, category and abstract, ...).

All fields marked (with an asterisk) are mandatory and have to be filled in. XRPS will accept the input when clicking on the “commit” button. This will enter the information in the intermediate memory described in § 4.3. In case an entry in a “mandatory” field is missing, an error message will be returned, specifying which field does not contain a proper entry. In such a case, change it accordingly and try again to commit the information to memory.

It is strongly recommended to **fill in also the “non-mandatory” fields** as detailed as possible. This will help a lot facilitating the *enhancement* process of the proposal afterwards.

5.2 Proposal details page

The proposal details page is the first page to show the typical frames layout of the XRPS forms, as described in § 4.4 and displayed in Fig. 4.

Each proposal contains already some information given by the PI when applying for XMM-Newton observing time (e.g. target names, coordinates, total observation duration, proposal titles and abstracts, personal details of PI and Co-Is, ...). **The user should verify that this information is correct but is not supposed to apply major changes to these parameters**, since this was the basis for the OTAC to distribute the **XMM-Newton** AO-6 observing time.

The functional buttons at the bottom of this page have been described in § 4.4.3. Input for each proposal starts with the proposal details page, where the following information is required (those items marked with asterisks being mandatory input again):

1. The proposal title

The maximum allowed length of a title is 80 characters.

The default is the title given by the PI.

2. Proposal type

For AO-6 the following proposal types are available:

- **Guest Observer**
- **Triggered Observations**

- **XMM-Newton/Chandra**
- **XMM-Newton/VLT(I)**
- **Large Programs**

For more details see the Policies and Procedures document.

Default is the proposal type given by PI.

3. Proposal category

XRPS offers a choice of proposal categories matching the composition of the **XMM-Newton** Observatory Time Allocation Committee (OTAC) panels. The available categories are:

- **Stars, White Dwarfs and Solar System**
- **White Dwarf Binaries, Neutron Star Binaries, Cataclysmic Variables, ULXs and Black Holes**
- **Supernovae, Supernova Remnants, Diffuse (galactic) Emission and Isolated Neutron Stars**
- **Galaxies and Galactic Surveys**
- **Active Galactic Nuclei, Quasars, BL-Lac Objects**
- **Groups of Galaxies, Clusters of Galaxies and Superclusters**
- **Cosmology, Extragalactic Deep Fields and Area Surveys**

Default is the proposal category given by PI.

4. Abstract

Please enter the proposal abstract using the editor window provided (max. 10 lines with 80 ASCII characters).

Default is the abstract given by PI.

5. Associated proposals

In case one proposal depends heavily on the outcome of another, the other (“associated”) proposal should be mentioned here. If you have received back an email acknowledging receipt of the associated proposal (including a proposal identification number), please provide first the number, followed by the proposal title (max. 80 characters altogether).

It is also necessary to create “associated proposals” if your programme includes more than 50 observations. 50 is the maximum number of observations the XRPS can handle within one proposal.

Default is empty

6. Optical Follow-up

Choose between SSC and GO. The meaning of “SSC follow-up” is explained in the following:

Selecting the “SSC” Follow-up option

By choosing this option proposers indicate that they are willing for the **serendipitous** content of their **XMM-Newton** EPIC observations to be included in the follow-up programme being conducted by the **XMM-Newton** Survey Science Centre (SSC) as part of its responsibilities to the **XMM-Newton** project. In this context “**serendipitous**” refers to X-ray sources detected within the EPIC field of view but **not associated** with the target of the observations. A summary of the SSC Follow-up Programme and other SSC activities is given in the **XMM-Newton** Users’ Handbook (UHB). The overall goal of the SSC programme is to support the community’s access to, and exploitation of, the serendipitous data from **XMM-Newton**, and as such all the results will be made public through the **XMM-Newton** science archive. It should be stressed that the SSC programme involves the follow-up/identification of only a small fraction of the serendipitous sources that **XMM-Newton** will detect. The emphasis of the SSC programme is on the characterisation of the **XMM-Newton** source population through the detailed follow-up of well-defined, small subsamples.

Agreeing to this option does not alter the observer’s proprietary rights for the intended target of the observation. For the serendipitous source content of the field it indicates that the observer allows access to the **non-target** sources by the SSC for the specific purposes of the follow-up programme, and those purposes only. **XMM-Newton** serendipitous source data only enters the public domain once the proprietary period expires. *This applies equally where the observer grants follow-up permission: there is no question of such data entering the public domain at an earlier stage.*

Except where there are alternate plans to conduct a follow-up programme based on the serendipitous X-ray source content of their XMM fields, observers are encouraged to agree to the SSC follow-up option. This will help to ensure the success of the SSC’s programme which is being conducted for the benefit of the whole community. Where any uncertainty exists in the precise definition of the intended target of the **XMM-Newton** proposal the SSC will always undertake to clarify this with the observer, via the **XMM-Newton** Project Scientist. For details consult the Policies and Procedures document.

Default is SSC.

Still within the main input window of the page, the three functional buttons “Commit”, “Add Co-I” and “Add Observation” are displayed, which offer the following functionality.

- Commit

As before; commit the proposal details that were entered into the form to the working memory. If you do not commit your entries to memory before moving on, you will lose what you have typed in.

- Add Co-I

Up to now only the PI personal information has been entered. All details about each Co-Investigator must be entered too. Fill in a separate page for each Co-I (see § 5.2.2).

- Add Observation

After providing general proposal information the proposer can now continue by entering details about the proposed science observations into an observation page (§ 5.2.3), choosing the “Add Observation” option.

5.2.1 PI details page

On this page the address information of the Principal Investigator (PI) is entered. Although not all entries are marked as compulsory, this form should be filled in completely to make it easy for the **XMM-Newton** SOC to get in touch with the observer in case of need. **It is extremely important that the “email” address is correct and up-to-date.** Otherwise, the PI will not receive the acknowledgement sent via email after submission of his proposal. Furthermore, all future interaction and communication between the PI and the SOC will be based on this Email address.

“First Name” and “Surname” of the PI cannot be changed. A screen shot is shown in Fig. 6. The use of acronyms for the institute names (e.g., “ESTEC” instead of “European Space Technology and Research Centre”) is permitted if necessary to save space.

5.2.2 Co-I details page

The same information as for the Principal Investigator of the proposed project is required for each Co-Investigator, except for the user identification giving access to the proposals in the working memory. When finished with a page, use the commit button, as usual, to commit the information to memory.

At the bottom of each Co-I details page there is a “Delete Co-I Entry” button to remove a Co-I from the list of authors again.

When finished, and after committing information to memory, use the navigation tool to go back up by one level to the proposal level (§ 5.2). There, either more Co-Is may be added, or users can proceed to the “Add Observation” option, to enter observation details.

5.2.3 Observation details page

This is the top-level page for each observation within a proposal (i.e., in almost all cases, the top-level page for observations of one particular target), see Figs. 7 and 8.

When opening a proposal for the first time it contains already the observations that OTAC assigned to the successful PI but only the first ten parameters are defined already. For technical reasons dummy values had to be given to the fields “Source Unabsorbed X-Ray Flux (ergs cm⁻²s⁻¹): 9.000e+00” and “Hydrogen Column Density (atoms cm⁻²): 1.0000e+3”. These values have to be changed by the user to reasonable values to allow a successful “committing” of the page. At this level, the following information is required (all fields marked with asterisks being mandatory).

- Target Name

Please use the most commonly used name of the target (max. 20 characters). The first eight characters will be used in the navigation tool (left frame) as the identifier of the observation.

Principal Investigator 2259

Title ★

First name Michel

Surname Breittellner

Institute ★

Address Line 1 ★

Address Line 2

Town ★

State

Country SPAIN

★

Post Code ★

Email ★

Telephone

Fax

Figure 6: Screen shot of the “PI personal information” page.

- Nominal Target Type

This “HEASARC Object Classification” parameter is used to select objects according to their classifications. Clicking on the title “Nominal Target Type” in the form will open a separate window displaying the list of “Object Classes” listed below in this chapter.

Each object is assigned a four digit numeric code to represent its object classification. The first digit describes the global classification (e.g., AGN or star). The following digits assign further classifications or properties such as spectral type, or type of AGN. Each sub-class is chosen to contain a unique set of properties. For example, all normal (non-degenerate) stars have the first digit set to 2. The second digit for stars indicates the spectral type (O, B, etc.), the third digit the numerical sub-type, and the last digit the luminosity class;

Proposal 2648, Observation 1

Target Name	3C 273			★
Nominal Target Type	7200	10		★
	QSO			
	radio loud			
	7210			
Observation Type	Non-Fixed			★
Coordinated Observation	<input type="radio"/> Yes <input checked="" type="radio"/> No			★
Right Ascension	12 H 29 M 06.7 S (J2000)			★
Declination	02 D 03 M 08.6 S (J2000)			★
Total Observation Duration (sec)	85000			★
Alternative Names				
Boresight RA	12 H 29 M 06.7 S (J2000)			
Boresight DEC	02 D 03 M 08.6 S (J2000)			
Scientific Prime Instrument	RGS			★
Inclusive Position Angle Constraints				
(deg)				
Lower		Upper		
Lower		Upper		
Lower		Upper		
Lower		Upper		

Figure 7: Screen shot of an “Observation” page (top part).

thus, a G5V star will have the class code of 2555. All stars later (cooler) than F0 have a “class” number between 2400 and 2999. As another example, all AGN have class codes that lie between 7000 and 7999; a search by class for AGN would thus be made by doing a search of the class parameter with the range set from 7000 to 7999.

It should be emphasized that the class assignments of the same source found in different databases may not always be identical, and, for any given database, the class codes may not always be present, correct, or complete: see the database help for the particular database in question to determine how the class codes were constructed. ALWAYS USE THE CLASS CODES WITH THESE CAVEATS IN MIND.

Object Classes

1000 - X-ray binary		
1100 - HMXRB	10 - X-ray pulsar	1 - flares
1200 - HMXRB supergiant	20 - burster	2 - jets
1300 - HMXRB Be star	30 - black hole	3 - eclipsing
1400 - LMXRB	40 - QPO	4 - ultra-soft transient

1500 - LMXRB Globular cluster	50 - QPO & black hole	5 - soft transient
	60 - QPO & pulsar	6 - hard transient
	70 - QPO & bursts	7 - eclipsing dipper
	80 - QPO,pulsar,bursts	8 - eclipsing ADC
	90 - pulsar & bursts	9 - dipper
1600 - CV	10 - Classical Nova	1 - oscillations
	20 - Recurrent Nova	2 - coherent osc.
	30 - AM Her (polar)	3 - fast
	40 - Intermediate polar	4 - slow
	50 - Dwarf nova	5 - eclipsing
	60 - Dwarf nova U Gem type	6 -
	70 - Dwarf Nova Z Cam type	7 -
	80 - Dwarf Nova SU Uma type	8 -
	90 - Nova like	9 -
1700 - Gamma ray	00 - source	1 - pulsar
	10 - burst	
	20 - burst, soft repeater	
1800 - Radio Pulsar		
1810 - X-ray pulsator		
1820 - Supersoft source		
1830 - Isolated neutron star		
1840 - Anomalous X-ray pulsar (AXP)		
1850 - Extrasolar planet		
1860 - Brown dwarf		
1870 - Protostar of Type 0		
1880 - Protostar of Type I		
1890 - Luminous Blue Variable (LBV)		
1900 - RS CVn star		
1910 - Algol star		
1920 - Beta Lyr star		
1930 - W UMa star		
1940 - Symbiotic star		
1950 - Zeta Aurigae star		
1960 - FK Comae star		
1970 - UV Ceti type		
1980 - T Tauri star	1 - (naked)	
	2 - (post)	
1990 - Herbig Ae/Be star		
1991 - Be star		
2000 - Wolf Rayet	00 - unknown type	00 - spectral type unknown
	10 - WN	10..... 1
	20 - WC	20..... 2
	30 - WO	30..... 3

40..... 4
 50..... 5
 60..... 6
 70..... 7
 80..... 8
 90..... 9-11

	00 - spectral type 0	0 luminosity class unknown
2100 - O	10..... 1	1 I or 0
2200 - B	20..... 2	2 II
2300 - A	30..... 3	3 III
2400 - F	40..... 4	4 IV
2500 - G	50..... 5	5 V
2600 - K	60..... 6	6 VI
2700 - M	70..... 7	
2800 - Me	80..... 8	
	90..... 9	

2900 - Star

10 - Luyten color class a
 20 - Luyten color class a-f
 30 - Luyten color class f
 40 - Luyten color class f-g
 50 - Luyten color class g
 60 - Luyten color class g-k
 70 - Luyten color class k
 80 - Luyten color class k-m
 90 - Luyten color class m

3000 - Extended galactic or extragalactic

3100 - SNR Crab-like	10 - Shell	1 - Radio Pulsar
3200 - SNR	20 - Filled-center	2 - Type I
3300 - Star forming region	30 - Composite	3 - Type II
3400 - Cloud	40 - Dark	
3500 - Nebula	50 - Molecular	
3600 - Open star cluster	60 - Planetary	
3700 - OB association/HII region	70 - Reflection	
3800 - Herbig-Haro object	80 - Globular Cluster	
3900 - Diffuse X-ray emission		

4000 - White dwarf	00 -	0 -
4100 - White dwarf DA	10 - A	1 - PNN
4200 - White dwarf DB	20 - B	2 - PNN detached binary
4300 - White dwarf DC	30 - C	3 - detached binary
4400 - White dwarf DO	40 - O	4 - O
4500 - White dwarf DZ	50 - Z	5 - Z

4600 - White dwarf DQ	60 - Q	6 - Q
4700 - White dwarf DX	70 - X	7 - X
4800 - White dwarf sD	80 - V	8 - P
4900 - White dwarf PG1159-type	90 - P	9 - H
5000 - Cluster of galaxies	10 - Abell class <0	1 - Cooling Flow
	20 - Abell class 0	
	30 - Abell class 1	
	40 - Abell class 2	
	50 - Abell class >2	
	60 - non-Abell	
5100 - Compact group of galaxies		
5500 - X-ray background		
6000 - Non-active galaxy		
6100 - Dwarf Galaxy	10 - radio loud	1 - flat radio spectrum
6200 - Spiral galaxy	20 - HII region	2 - steep radio spectrum
6300 - Elliptical galaxy	30 - Multiple nuclei	3 - inverted radio spectrum
6400 - Starburst galaxy	40 - Barred	
6500 - Interacting galaxy	50 - Unbarred	
6600 - Irregular galaxy	60 - Mixed	
6700 - Galaxy	70 - Nebulous region	
6800 - Lenticular galaxy		
6900 - Normal galaxy		
7000 - AGN Unclassified		
7100 - Seyfert	10 - radio loud	1 - flat radio spectrum
7200 - QSO	20 - radio loud/polarized	2 - steep radio spectrum
7300 - BL Lac	30 - radio quiet	3 - inverted radio spect
7400 - Liner	40 - radio loud/invert sp	4 - type 1
7500 - Radio Galaxy	50 - radio loud/flat sp	5 - type 1.5
7600 - IR Galaxy	60 - radio loud/steep sp	6 - type 2
7700 - OVV	70 - radio pol/invert sp	
	80 - radio pol/flat sp	
	90 - radio pol/steep sp	
7800 - NEL (Narrow Emission-Line) galaxy		
7900 - NLS1 (Narrow-Line Seyfert 1) galaxy		
8000 - Solar system object		
8100 - Planet	10 - Mercury	
	20 - Venus	
	30 - Earth	
	40 - Mars	
	50 - Jupiter	
	60 - Saturn	
	70 - Uranus	

	80 - Neptune
	90 - Pluto
8200 - Solar Feature	10 - Quiet Sun
	20 - Active Sun
	30 - Sunspot
	40 - Plage/Active Region
	50 - North Pole
	60 - South Pole
	70 - Equatorial Region
	80 - Mid-Latitude Region
	90 - Flare
8300 - Asteroid	10 - Main Belt Object
	20 - Centaur
	30 - Kuiper Belt Object
	40 - Near-Earth
8400 - Comet	10 - Periodic
	20 - Non-Periodic
	30 - Sun-Grazing
8500 - Moon	
9000 - Unusual object	
9100 - Supernova	10 - Type I
	20 - Type II
9200 - Hypernova	
9999 - unidentified	

- Observation Type

Depending on the proposal type specified above the type of observation intended must be filled in here. In case of a normal GO proposal the choice is between “Fixed” or “Non-fixed”, referring to the time of the planned observation. An observation is “Fixed” if it must be carried out (due to the object’s properties or a certain required constellation) at a specific date and time, or at predefined intervals. More details on which entries are required for fixed observations follow in § 5.2.3.2. Observations without time constraints are “Non-fixed”. Note, that the above refers only to scientific constraints, and **not** to the constraints imposed by the target visibility. Therefore, an observation of a target that is visible only during part of the AO-6 observing period is NOT fixed.

- Coordinated Observation

If your **XMM-Newton** observation should be coordinated with observations of other instruments (e.g. Chandra, RXTE, HST, VLT etc.) you should indicate this here changing the flag from “No” to “Yes”.

- Right Ascension and Declination (J2000)

All coordinate entries MUST be made in the J2000 equinox, in the “hh mm ss.ss” format for right ascension hours, minutes and seconds (valid

input range is from 00 00 00.00 to 23 59 59.99) and in the “[sign]dd mm ss.s” format for declination in degrees, minutes and seconds of arc (valid input range is from -89 59 59.9 to 89 59 59.9).

- Total Observation Duration (sec)

The **total** proposed length of the observation, including all exposures, in seconds. This time is the net science integration time plus the instrument overhead times and eventual offset times between exposures. These overhead times will be calculated when doing the “Check Proposal”. The maximum allowed value for the observation duration is 144 000 s due to the characteristic of the **XMM-Newton** orbit. The minimum value for **XMM-Newton** observations, in order to keep the observatory efficiency high, is 6 500 s. In fact, the definition of the minimum is related to the effective net exposure time which should not be less than 5 000 s. Depending on the prime instrument chosen (EPIC or RGS) overhead times can vary a lot (see Tab. 1).

Users requiring a total integration time of more than 144 000 s (which is the approximate maximal continuous visibility for **XMM-Newton** of any point on the sky) for an observation are requested to split their programs into as many individual observations of up to 144 000 s as needed to reach the required total integration time.

Users have also to check the visibility of their targets using the **XMM-Newton** Target Visibility Tool. Observations longer than the available maximum visibility will not pass the “Technical Evaluation”. It might be necessary to split the observations in smaller pieces which can be accommodated in different revolutions.

It should also be taken into consideration that targets with limited visibility are normally visible only at the beginning or at the end of a revolution. This means that, depending on the conditions in the radiation belts, useful visibility might be shortened by up to 10 000 s.

XRPS will calculate the sum of all exposure, overhead and offset times (see § 5.2.4.1 for more details on “Exposure Offset” times) for all **XMM-Newton** instruments per observation of a proposal and compare this with the total observation duration. If the sum is higher than the observation duration, XRPS will raise an error condition. If the sum for the X-ray instruments is lower than 97% of the total observation duration, another error message is issued. In both cases the exposure times have to be corrected. For OM observations only the maximum limit gives an error while exposure times less than 97% of the total observation time just issue a warning message. The reason is that in case there is an optically bright source in the OM FOV, no OM exposure should be included. The SOC will use this time for performing OM calibrations with Filter Wheel in “Blocked” position.

- Alternative Names

Other object names, if any (max. 40 characters).

- Boresight RA and DEC (J2000)

The coordinates defining the direction in which **XMM-Newton** will actually be pointing. The requested boresight coordinates can differ from the target's centre coordinates, e.g., in case of extended targets (if the observer wants to point to an off-centre position within the extended target (for which still the centre coordinates should be listed above under item 5.2.3)).

The boresight coordinate input fields may be left empty. If so, the target coordinates will, when hitting the commit button, automatically be propagated. The format is the same as in the target coordinate input fields above. Please note that when the target coordinates are changed again AFTER first committing them to memory, the boresight fields are also updated again.

It should always be kept in mind that when pointing off-axis, the calibration of the RGS may not be optimal due to shifts in the wavelength scale as a function of source position. For off-axis angles of $\geq 2'$ (in the RGS's cross-dispersion direction) the spectrum of a source will not fall on the RGS chips. See also the comments below regarding the choice of prime instrument.

Note that also the OM standard configurations are optimised for on-axis targets.

- Prime Instrument

Choosing the instrument that is most important to achieve the proposed scientific goals will ensure proper placement of the target on the prime instrument for optimal data quality. See the UHB chapter on instrument alignment for details.

The successful performance of the exposures carried out with the prime instrument also serves to define whether the observation as a whole is considered as successful or flagged as failed. The details about success and failure criteria, and eventual compensatory observing time for failed observations are described in the Policies and Procedures document.

In AO-6 the user can select either EPIC or RGS as prime instrument. Users with a strong interest in RGS dispersive spectroscopy should declare RGS the prime instrument. The OM cannot be chosen as prime instrument.

- Inclusive Position Angle Constraint (deg)

Especially in case of crowded fields or bright sources in the vicinity of the science target, users will want to avoid these sources, in particular during dispersive spectroscopic observations. Therefore, observers must make sure that nearby sources do not interfere with the science target's spectrum by being located along the dispersion direction of the RGS.

Note: The **XMM-Newton** Target Visibility Tool can be used to determine the range of permitted position angles (PAs) for each revolution. The user is allowed to specify up to four different PA ranges between 0 and 360 degrees. Each range of allowed PAs shall not be smaller than 10 degrees.

The following entries are requested by the SOC to assist the **XMM-Newton** user support astronomers in conducting feasibility studies for the execution of the proposed programme. These are used as technical input for the OTAC to review.

Source Extent (deg)	<input type="text" value="0.001"/>	★
Variable Source	<input type="radio"/> True <input checked="" type="radio"/> False	★
Source Unabsorbed X-ray Flux (ergs cm ⁻² s ⁻¹)	<input type="text" value="1.000e-10"/>	★
Lower Flux Band Limit (keV)	<input type="text" value="1"/>	★
Upper Flux Band Limit (keV)	<input type="text" value="10"/>	★
X-ray Spectral Model	<input type="text" value="Power Law"/>	★
Determining Model Parameter	<input type="text" value="1.6"/> (kT [keV] or Γ)	★
Hydrogen Column Density (atoms cm ⁻²)	<input type="text" value="1.8000e+20"/>	★
Target Optical Spectral Type	<input type="text" value="A"/> <input type="text" value="0"/> (O, B, A, F, G, K, M, Rn, Nn, Sn; 0-9)	★
Target Visible Magnitude	<input type="text" value="12.8"/>	★
SOC Enhance Request	<input type="radio"/> Yes <input checked="" type="radio"/> No	

Figure 8: Screen shot of an “Observation” page (bottom part).

- Source Extent (deg)

Extent of the source’s X-ray emission, if extended, in units of degrees; if not circular, please enter mean value. This is used for count rate calculations and to see whether an extended source will fit into the FOV. Allowed input range is from 0.0 to 20.0 degrees.

- Variable Source

Flag that will help in technical feasibility studies and make sure that varying count rates do not come as a surprise in the Quick Look Analysis (QLA) of the incoming data. Allowed inputs: True / False

Please specify “Variable Source: True”, if the source flux in the **XMM-Newton** energy band (0.1–15.0 keV) is expected to vary by a factor of 2 or more (during the observation), on the basis of known source characteristics. If photon pile-up is a concern, users should orient their pile-up calculations for variable sources at the UPPER end of the expected flux range. If not sure about source variability, leave the flag at its default value (“False”).

- Source Unabsorbed X-ray Flux (erg s⁻¹ cm⁻²)

In units of erg s⁻¹ cm⁻², over the passband to be defined below. Entries can

be made as 1.5×10^{-13} for 1.5×10^{-13} [erg s⁻¹ cm⁻²]. For count rate conversion from previous satellite missions and flux-to-count-rate conversions, the usage of the PIMMS software is recommended.

If the source extent should exceed 30' (diameter), please provide the flux within a 30' region, centred on the boresight coordinates. The allowed input range is from 0.0 to 1.0×10^{-7} erg s⁻¹ cm⁻².

- Lower Flux Band Limit (keV) and Upper Flux Band Limit (keV)

Energy range over which the above X-ray source flux has been determined. The allowed input range for the “Lower Flux Band Limit” is from 0.1 to 10.0 keV and for the “Upper Flux Band Limit” is from 1.0 to 15.0 keV. Of course, the “Lower Flux Band Limit” must be smaller than the “Upper Flux Band Limit”.

- X-ray Spectral Model

X-ray spectral model approximating the source spectrum in the energy range from 0.1 to 15.0 keV (the **XMM-Newton** passband); choose between

- **Black Body**
- **Power Law**
- **Thermal Bremsstrahlung**
- **Raymond-Smith**

if any of these provides an acceptable approximation, in particular in the energy range that is most important for the proposed science. Even if you are not entirely happy with any of these models, choose one and set the parameters in such a way, that the resulting count rate equals more or less the count rate calculated with your model in the energy range you are most interested in.

- Determining Model Parameter (kT or Γ)

Depending on the above X-ray spectral model, enter here the best-fitting value of the characteristic parameter, i.e.,

- kT (keV) for “Black Body” allowed input range from 0.05 to 30.0 keV,
- Γ photon index for power laws (following the convention $F_{\text{photon}} \propto E^{-\Gamma}$), allowed input range from -15.0 to 15.0
- kT (keV) for “Thermal Bremsstrahlung” allowed input range from 0.05 to 30.0 keV,
- kT (keV) for “Raymond-Smith” allowed input range from 0.1 to 28.0 keV.

- Hydrogen Column Density (atoms cm⁻²)

Absorbing column density, in units of cm⁻²; if known, please provide a fit result from existing X-ray data. For extragalactic sources with either negligible or highly inhomogeneous internal absorption, please provide the value for the Galactic foreground absorption. Exponential notation is again possible, e.g.: 3.78e20 for 3.78×10^{20} cm⁻². The allowed input range is from 0.0 to 5.0×10^{23} cm⁻².

- Target Optical Spectral Type (O, B, A, F, G, K, M, Rn, Nn, Sn; 0-9)

Especially for planning OM observations it is important to know the spectral type of stars, in particular bright ones. UHB Table 23 lists OM brightness limits. In case these brightnesses are exceeded (and **it is the user's responsibility to check for the presence of bright sources in the OM field of view**) no OM exposure should be defined. Consequently, no OM data will then be acquired during the observation. Allowed Spectral types are O, B, A, F, G, K, M, Rn, Nn, Sn with subclasses from 0 to 9.

- Target Visible Magnitude

Johnson V magnitude of target, if known (or best guess of upper brightness limit). For extended targets, e.g. galaxies, please provide maximum surface brightness, in units of V magnitudes per square arcsec. Allowed input range is from 0.00 to 30.0 mag.

- SOC Enhance Request

In case of doubt about the optimal observation setup, users can request SOC assistance for optimising an observing programme. However, **please read § 7** before filling in this field.

Finally, use the commit button to enter the information into memory.

By now, the navigation tool (§ 4.5) in the left hand window should show one file per Investigator, with the PI in first place, followed by a directory which has just been created for entries regarding the first observation of the proposal (cf. Fig. 5).

5.2.3.1 Functional buttons at the bottom of the observation details page

At the bottom of each observation page three rows of functional buttons can be found. Those in the two upper rows will be described in section 5.2.4. But before doing so, here is a brief description of the functions offered by the keys in the lower row. These are: “Copy Observation”, “Add Time Details” and “Delete Observation”.

- “Copy Observation”

In many programmes which include more than one observation, the different observations are likely to be similar with respect to the observation details (such as, e.g., the number of exposures per observation, the prime instrument, the choice of filters, etc.). Thus, once all details of one observation (including all exposures, as described below) have been filled in, it can be used as a template for other, similar ones, to minimise the manual input and thus the amount of time spent filling out the proposal formsheets.

Copying an observation will lead to an update of the navigation tree on the left-hand side. When subsequently changing entries in a copied observation (in particular the target name) or in an exposure form, no existing page is deleted or new page created. Thus, XRPS is not triggered to automatically update the navigation tree. If the target name should have changed, press “Reload” on your browser to update the navigation tree.

In case it should be easier to just type in the details of different observations manually, instead of copying, please first commit all data to memory before clicking on the “Proposal” directory in the navigation tree on the left (Fig. 5) to go back up to the top-level “Proposal Details” page and use the “Add Observation” function key to proceed from there (§§ 5.2 and 5.2.3).

- “Delete Observation”

Pressing this button, a whole observation, including all its exposures and associated time details (if any), is deleted. A verification request will appear before performing the deletion.

- “Add Time Details”

This button is only visible if “Observation Type” is set to “Fixed”. Time-critical observations need additional entries to specify when they must be conducted. These entries are made in a special time constraints page (§ 5.2.3.2).

5.2.3.2 Filling in time constraints

For each “Fixed” (i.e., fixed-time) observation, a special “Time Constraints” form must be filled in. Observations with Position Angle constraints should **NOT** be flagged as “Fixed” time observations. A screen shot of this page is displayed in Fig. 9.

The form offers four different sections, labeled as:

- “Complete if you want to fix XMM-Newton Revolution”
- “Complete if you want to fix UT”
- “Complete if you want to fix Orbital Phase”
- “Comments”

The first three sections are exclusive. This means that you can fill in only one section at a time depending on the kind of time constraint you want to use.

Inputs can be made either in the “Earliest Revolution” and “Latest Revolution” input fields (where relative times are required) or the “Earliest Start Time” and “Latest Start Time” input fields (where absolute times are required). The allowed input range for AO-6 for “Earliest Revolution” is between 730 and 970 **XMM-Newton** revolutions or between 2003.13.03.00.00.00 and 2005.03.26.00.00.00 UT for “Earliest Start Time”. Input values for “Latest Revolution” have to be equal or greater than “Earliest Revolution”. Input values for “Latest Start Time” have to be equal or greater than values of “Earliest Start Time” **plus one hour**. A specified range can also be left open at the minimum or maximum side or both (to allow for non-fixed repetitions) using the “Any” button.

There is also the possibility of repeating an observation, specifying the number of repetitions “Repeat x times” (0-98), the period “every x orbits/days” (1-999 rev., 0.42-999.99 days) and the “tolerance” (1-998 rev., 0.04-period days).

For the special case of observations related to orbital phases the third section of the “Time Constraints” page offers additionally the possibility of specifying the “Reference time for Phase0” in UT format YYYY.MM.DD.HH.MM.SS, the “Period” (0.4200-366) in days, the “Phase” requested, and finally the “tolerance” in days.

Time Constraints : Proposal 1521, Observation 1

Specify Observation Time Constraints using:

XMM-Newton Revolution	
Earliest Revolution	<input type="text"/> <input type="checkbox"/> Any
Latest Revolution	<input type="text"/> <input type="checkbox"/> Any
Repeat	<input type="text"/> times, every <input type="text"/> Revolutions, tolerance <input type="text"/> Revolutions.
OR	
Absolute Time (UT)	
Earliest Start Time	<input type="text"/> <input type="checkbox"/> Any (YYYY.MM.DD.HH.MM.SS)
Latest Start Time	<input type="text"/> <input type="checkbox"/> Any (YYYY.MM.DD.HH.MM.SS)
Repeat	<input type="text"/> times, every <input type="text"/> days, tolerance <input type="text"/> days.
OR	
Phase	
Earliest Start Time	<input type="text"/> <input type="checkbox"/> Any (YYYY.MM.DD.HH.MM.SS)
Latest Start Time	<input type="text"/> <input type="checkbox"/> Any (YYYY.MM.DD.HH.MM.SS)
Reference time for Phase 0	<input type="text"/> (YYYY.MM.DD.HH.MM.SS)
Period	<input type="text"/> days; Phase <input type="text"/> (<1.0); tolerance <input type="text"/> in days
Repeat	<input type="text"/> times <input type="checkbox"/> Consecutive
Comments	
<small>Only for observations that are more complicated than can be entered in the fields above. Max. comment length 400 characters.</small>	
<input type="text"/>	
<input type="button" value="Commit"/> <input type="button" value="Clear Form"/> <input type="button" value="Delete Entry"/>	

Figure 9: Screen shot of the “Time Constraints” page in which entries for time-constrained observations must be made.

Example: To ask for repeated observations, spaced at certain time intervals, but at no particular time, enter an “Earliest Revolution / Start Time”, a “Latest Revolution / Start Time” and specify how often the observation should be repeated. If, for example, two observations are needed, the “Repeat” parameter has to be set to 1 (repetition). Setting “Repeat” to 0 means that only one observation will be performed. The buttons at the bottom serve to either “Commit” your input, “Clear Form” or “Delete Entry” completely.

The XMM-Newton SOC will handle absolute (UT, orbital phase) and relative (XMM-

Newton revolution) time entries into XRPS in the following way:

Observations which MUST be conducted at a fixed time .

For observations which MUST be conducted at a fixed time, e.g. an occultation experiment, absolute time entries must be entered into the proposal database via the “Time Constraints” page. The required format, as displayed on the formsheet, is YYYY.DDD.HH.MM.SS (i.e., four digits for the year, three digits for the day of the observations [the number of the day in that year] and two digits for hours, minutes and seconds in the 24 hours format). The separator is a dot, not a colon. Naturally, the requested time constraint has to be in agreement with the **XMM-Newton** visibility of the target. Therefore the user must perform a visibility check, using the **XMM-Newton** Target Visibility Tool. The absolute entry will be used by the SOC to check whether the target is visible. If so, the SOC will try to schedule the observations at the requested date and time.

Time-constrained observations that are not fixed to a particular date/time .

Complex repetition patterns should be described in the “Comments” section of the “Time Constraints” page. The SOC will then later on take care of the proper scheduling, interacting with the PI during the “enhancement” process of his proposal.

Note: In the case of repeated observations, the science duration specified on the observation page applies to each observation. It is not the sum over all repeated observations (because each is, as the name suggests, handled as an individual observation).

5.2.4 Entering exposure details

Before starting to enter exposure details, it is worth considering how XRPS will handle entries internally. Within an observation, a subdirectory is opened for each exposure. For each of the **XMM-Newton** science instruments at least one exposure must be specified. The suggested order (as mentioned already in § 4.6) is

1. EPIC MOS-1
2. EPIC MOS-2
3. EPIC pn
4. RGS-1
5. RGS-2
6. OM

Thus, the recommended sequence of steps to fill out the exposure details for an observation, using the top row of functional keys at the bottom of the observation details page, is to first proceed to “Add EPIC MOS” and, once finished with all EPIC MOS-1 and EPIC MOS-2 exposures, to “Add EPIC pn”, before going on to “Add RGS” and “Add OM”, as often as necessary to fill in all required exposures (see the following paragraphs).

Alternatively, a functional button at the bottom of each exposure page can be used to copy exposures. Also at the bottom of the page there is a button to delete each exposure again.

A much **faster way** of doing this is to use the first button in the second row “Add Standard Exposures” which leads to a form (see Fig. 10) where “Instrument Mode” and “Filter Wheel” of the five **XMM-Newton** X-ray instruments can be defined in one go.

Proposal 20571, Observation 2

Observation duration: 23000 seconds

Instrument	Instrument Mode	Filter Wheel	Instrument Overhead	Exposure Duration
EPIC MOS 1	Full Frame	THIN FILTER	-	-
EPIC MOS 2	Large Window	MEDIUM FILTER	-	-
EPIC pn	Small Window	THICK FILTER	-	-
RGS 1	Spectroscopy	N/A	-	-
RGS 2	Spectroscopy (HCR)	N/A	-	-

Calculate Exposure Times

Return to Observation

Figure 10: *Form to create standard exposures of all five XMM-Newton X-ray instruments in one go before calculating the exposure times*

Pressing the “Calculate Exposure Times” button calculates automatically “Instrument Overhead” and “Exposure Duration” for each instrument and enables the button “Create Exposures” (see Fig. 11) to finally create all five exposures in one go.

OM exposures have to be added manually because the times of multiple exposures can not be adjusted automatically. For maximum scientific yield, unless the user has specific requirements, it is recommended to make a series of exposures with filters “UVM2”, “UVW1” and “U”. The mode has to be chosen according to the target characteristics (see 5.2.4.5).

XRPS will count all exposures belonging to one observation consecutively. The name of the instrument for which an exposure has been defined will be part of the file name visible in the navigation tool.

5.2.4.1 Filling in EPIC MOS details

Fig. 12 displays a screen shot of an EPIC MOS exposure form sheet. The following (mandatory) entries must be made there.

“Filter Wheel”, EPIC optical blocking filters The allowed choice of filters is presented in Tab. 2.

“Exposure Time (secs)” Valid range is between 0 and 144 000 s.

Proposal 20571, Observation 2

Exposure durations calculated.

Observation duration: 23000 seconds

Instrument	Instrument Mode	Filter Wheel	Instrument Overhead	Exposure Duration
EPIC MOS 1	Full Frame	THIN FILTER	555	22445
EPIC MOS 2	Large Window	MEDIUM FILTER	550	22450
EPIC pn	Small Window	THICK FILTER	1403	21597
RGS 1	Spectroscopy	N/A	80	22920
RGS 2	Spectroscopy (HCR)	N/A	57	22943

Calculate Exposure Times Create Exposures

Return to Observation

Figure 11: Form to create standard exposures of all five XMM-Newton X-ray instruments in one go after calculating the exposure times

Table 2: EPIC filters

Filter ¹	Description
CLOSED	Blocked filter position
THIN FILTER	Thin aluminium
MEDIUM FILTER	Medium aluminium
THICK FILTER	Thick aluminium Polypropylene

Note to Table 2:

1) During AO-6 only the highlighted filters are recommended for use.

“Exposure Offset (secs)” The exposure offset should be left at its default value of 0s to ensure continuous operation of the instrument. Only under special circumstances, under which one would **not** want the instrument to operate for a certain amount of time, should an offset with respect to the previous instrument exposure, if any, be defined here. Valid range is between 0 and 1 000 s.

“Instrument”, MOS camera unit When first entering this page, the “Instrument” query will have the two options “EPIC MOS 1” and “EPIC MOS 2” from which users must choose one, because exposures are defined independently for both instruments. Once specified, and once all entries have been made and successfully committed to memory, this is not a selectable parameter anymore, but the fixed entry will appear on the form sheet, as displayed in Fig. 12. Therefore, it is not possible to change a MOS-1 exposure to a MOS-2 exposure without copying it.

“Instrument Mode”, MOS modes of operation For a description of allowed EPIC

Proposal 1521, Observation 1, Exposure 1 : EPIC MOS

Filter Wheel ★

Exposure Time (secs) ★
Offset is from the end of the previous exposure

Exposure Offset (secs) ★

Instrument **EPIC MOS 1**

Instrument Mode ★
This number is based on the same instruments in this observation. This number will be calculated if left blank.

Order (ins. based) ★

Add New Exposure

Figure 12: Screen shot of an EPIC MOS exposure form sheet for a “Full Frame” imaging exposure with a length of 49328 s and an offset with respect to the previous exposure of 0 s. The “THIN FILTER” optical blocking filter was chosen.

modes see Tab. 3 and consult the UHB for details.

Table 3: *EPIC MOS mode names*

EPIC MOS mode name ¹
Full Frame
Large Window
Small Window
Timing

Notes to Table 3:

1) During AO-6 only the highlighted modes are recommended for use.

“**Order (ins. based)**” In this field you can define the sequence of exposures using the same instrument (e.g. OM) within an observation. If you do not specify this parameter explicitly, the exposures will be performed just in the order they were entered into XRPS.

5.2.4.2 Filling in EPIC pn details

In Fig. 13 a screen shot of an EPIC pn exposure formsheet is displayed.

Proposal 1521, Observation 1, Exposure 2 : EPIC pn

Filter Wheel ★

Exposure Time (secs) ★
Offset is from the end of the previous exposure

Exposure Offset (secs) ★

Instrument **EPIC pn**

Instrument Mode ★
This number is based on the same instruments in this observation. This number will be calculated if left blank.

Order (ins. based) ★

Add New Exposure

Figure 13: Screen shot of an EPIC pn exposure form sheet for an “Extended Full Frame” imaging exposure with a length of 45060 s and an offset with respect to the previous exposure of 0 s. The “MEDIUM FILTER” optical blocking filter was chosen.

The selectable parameters for the pn camera are again the EPIC filters, exposure time, exposure offset (which should normally be 0) and the EPIC modes.

“Filter Wheel”, Optical blocking filters The choice of optical blocking filters is the same as for EPIC MOS (see Tab. 2, in § 5.2.4.1).

“Exposure Time (secs)” Valid range is between 0 and 144 000 s.

“Exposure Offset (secs)” This should be 0 again in order to avoid times during which the instrument is idle. Valid range is between 0 and 1 000 s.

“Instrument”, pn camera unit There is only one EPIC pn camera, therefore the instrument unit is not a selectable parameter.

“Instrument Mode”, pn modes of operation The allowed EPIC modes are summarized in Tab. 4 and are described in the UHB in detail.

The UHB modes “Timing” and “Burst” are two flavours of the EPIC fast mode, where the “Burst” mode has an extremely short duty cycle. Both

Table 4: *EPIC pn mode names*

EPIC pn mode name ¹
Full Frame
Large Window
Small Window
Timing
Burst
Extended Full Frame

Notes to Table 4:

1) During AO-6 only the highlighted modes are recommended for use.

modes operate on one CCD (the one on which the nominal on-axis boresight falls).

“Order (ins. based)” In this field you can define the order of multiple exposures using the same instrument within an observation.

5.2.4.3 Filling in RGS details

Similarly to the EPIC exposures, a few details must be defined for each RGS exposure. Fig. 14 provides an example for an RGS exposure formsheet.

“Exposure Time (secs)” Valid range is between 0 and 144 000 s.

“Exposure Offset (secs)” The exposure offset should be left at its default value of 0 s to ensure continuous operation of the instrument. Only under special circumstances, under which one would **not** want the instrument to operate for a certain amount of time, should an offset with respect to the previous instrument exposure, if any, be defined here. Valid range is between 0 and 1 000 s.

“Instrument” When first entering this page, the “Instrument” query will have the two options “RGS 1” and “RGS 2” from which users must choose one, because exposures are defined independently for both instruments. Once specified, and once all entries have been made and successfully committed to memory, this is not a selectable parameter anymore, but the fixed entry will appear on the form sheet, as displayed in Fig. 14. Therefore, it is not possible to change a RGS 1 exposure to a RGS 2 exposure without copying it.

“Instrument Mode”, RGS modes of operation For a description of allowed RGS modes see Tab. 5 and consult the UHB for details.

“Order (ins. based)” In this field you can define the order of multiple exposures using the same instrument within an observation.

“Edit Details” Call the RGS setting form to specify the RGS CCD readout sequence. This is only necessary if a non-standard readout sequence is required. Otherwise the following default sequences are used:

Proposal 1521, Observation 1, Exposure 3 : RGS

Exposure Time (secs) ★

Offset is from the end of the previous exposure

Exposure Offset (secs) ★

Instrument **RGS 1**

Instrument Mode ★

This number is based on the same instruments in this observation. This number will be calculated if left blank.

Order (ins. based) ★

Add New Exposure

Figure 14: Screen shot of an RGS exposure form sheet for a 49909 s exposure and an offset with respect to the previous exposure of 0 s of RGS1 in the recommended mode for standard “Spectroscopy”.

Table 5: RGS mode names

RGS mode name ¹
Spectroscopy
Spectroscopy (HCR)

Notes to Table 5:

1) During AO-6 only the highlighted modes are recommended for use.

RGS 1 1,2,3,4,5,6,8,9

RGS 2 1,2,3,5,6,7,8,9

5.2.4.4 Filling in RGS exposure settings

For RGS, more details can be specified, depending on the instrument mode in which observations are to be carried out. These can be defined on a dedicated page, which is accessed by pressing the “Edit Details” button at the bottom of the exposure page.

Only the RGS CCD readout sequence is a user-selectable parameter. For normal observations over the whole energy range of the RGS, this sequence should not be changed. Only if users want to perform spectroscopy only over a part of the RGS passband or read out one or more chips faster than others, a different sequence can be chosen here. Each RGS has 9 CCD chips, but is read out in a cycle with up to 12 readout slots. The energy ranges

RGS Setting : Proposal 1521, Observation 1, Exposure 3

Readout Sequence

Update

Figure 15: Screen shot of an RGS-1 setting form. Note, that CCD 7 is not available.

covered by the different RGS CCDs in different grating orders are described in the UHB section 3.4.2 about RFC arrays (RFC standing for RGS Focal Camera). If a user should wish to read out a chip onto which a particularly strong and scientifically important line falls (e.g., no. 3) more often than all others, a readout sequence of, e.g., [3 1 2 3 4 5 3 6 3 8 9] could be chosen, with which chip #3 is read out 4 times as often as the others. Note, that for RGS-1 CCD 7 and for RGS-2 CCD 4 are not available.

5.2.4.5 Filling in OM exposures settings

An observation usually includes several OM exposures with different filters, or with the same filter. Users must choose one of the OM optical elements, the exposure time for that optical element, exposure offset (normally 0s) and one of the available OM modes. Consult the UHB for a detailed description of the instrument and the available observing modes. Also take a look at § 3.2 for a description of how to prepare a sequence of different exposures. A screenshot of an OM exposure form sheet can be seen in Fig. 16.

Proposal 2648, Observation 1, Exposure 1 : OM

Filter Wheel Exposure Time (secs)

Offset is from the end of the previous exposure

Exposure Offset (secs)

Instrument OM

Instrument Mode

This number is based on the same instruments in this observation. This number will be calculated if left blank.

Order (ins. based)

Commit

Copy Exposure

Delete Exposure

Delete all OM Exposures

Add New Exposure

Add EPIC MOS

Add EPIC pn

Add RGS

Add OM

Figure 16: Screen shot of an OM exposure form sheet for an exposure with the U filter (filter wheel position 3), in imaging mode, using RGS as prime instrument, with 1000 s exposure time for each of the five sub-exposures comprising the default configuration of an exposure in the "EPIC/RGS Image" mode.

“Filter Wheel” The user can choose one of the OM optical elements listed in Tab. 6. For maximum scientific yield the following three filters are recommended:

1. UVM2 (first choice)
2. UVW1 (second choice)
3. U (third choice)

Since the **sequence of exposures using different optical elements must always have increasing filter wheel position numbers** the three filters mentioned before have to be observed in the following order: U, UVW1 and UVM2.

Table 6: *OM optical elements*

Filter wheel position number ¹	Filter name
0	BLOCKED
1	V
3	U
4	B
5	WHITE
6	VISIBLE GRISM
7	UVW1
8	UVM2
9	UVW2
10	UV GRISM

Notes to Table 6:

1) Exposures using different optical elements must always have increasing filter wheel position numbers.

“Exposure Time (secs)” Due to internal memory capacity and telemetry bandwidth restrictions OM science exposures have a limited range of exposure times. The allowed input ranges are listed in Tab. 7.

“Exposure Offset (secs)” The exposure offset should be left at its default value of 0 sec to ensure continuous operation of the instrument. Only under very special circumstances one may want the instrument not operate for a certain amount of time, then an offset with respect to the previous instrument exposure has to be defined here. Valid range is between 0 and 1 000 sec.

“Instrument Mode” Depending on the target characteristics (size, variability, etc.) and on the available observation time the user is advised to use one or another Instrument Mode.

Table 8 shows an overview of possible OM modes.

All the possibilities and various examples are described in detail in the UHB, here we give a few simple cases as examples:

1) **Source extent less than 2 arcmin: “EPIC/RGS Image + FAST” Mode**

Table 7: *OM exposure time constraints*

Science window configuration	Minimum (s)	Maximum (s)
EPIC/RGS Image Mode	800	5000
EPIC/RGS Image + Fast Mode	1200	4400
Full Frame Low Resolution	1000	5000
Science User Def.: Up to 5 Image windows ¹	800	5000
Science User Def.: 1 Image + 1 Fast windows ²	1200	4400
Science User Def.: 1 Image + 2 Fast windows ²	1200	2200
Science User Def.: 1 to 4 Image + 1 Fast windows ²	1200	4400
Science User Def.: 1 to 3 Image + 2 Fast windows ²	1200	2200

Notes to Table 7:

- 1) The total number of allowed Science User Defined windows (IMAGE and/or FAST) is 5, with a maximum of 2 of them being FAST windows
- 2) **Important ! Check times carefully, time limits are not checked by the Technical Evaluation in XRPS in these cases.**

Table 8: *OM mode names*

Mode Name ¹	Prime Instrument
EPIC Image	EPIC
EPIC Image Fast	EPIC
RGS Image	RGS
RGS Image Fast	RGS
Full Frame Low Resolution	Any
Full Frame High Resolution ¹	Any
Science User Defined	Any

Note to Table 8:

- 1) This mode is not recommended for use because of very large overhead and risk of data loss during downlink.

In this mode the central 2' x 2' field is covered with high resolution and the rest of the field is also sampled (with less spatial sampling, and with less exposure time).

If the target is expected to vary during the observation time the user can introduce many exposures in the same filter. As for every mode, time discontinuities are to be expected due to overhead time before each exposure (see Table 1) and also due to possible Ground Station Handovers.

If the target is not variable it could be of interest to obtain spectral information performing exposures in different filters.

In addition the FAST window can provide the time variation of the central target (in a 10:5 x 10:5 window) with a time resolution of up to 500 ms.

IMAGE and FAST exposures are acquired simultaneously without extra time consumption.

2) Intermediate source extent/ high time efficiency/ flexibility: "Science User Defined" Mode

this mode is time efficient (small overhead time), flexible, and applicable to target sizes up to 7.6×7.6 arcmin.

A standard exposure in this mode would be an IMAGE window centered in the target, of $5' \times 5'$ (binning = 0×0) plus a FAST window of 10.5×10.5 also centered in the target with time slice duration of 500 ms.

When selecting this mode a new button appears: "Add Details", the user has to click on this button in order to define the exposure windows. Next section (§ 5.2.4.6) describes how to fill these exposure details.

3) Extended source (more than $7'.6 \times 7'.6$ arcmin): "Full Frame Low Resolution" Mode

this mode is recommended for a uniform observation of large fields. It has quite large overheads (see overheads in Table 1) requiring rather long observation time for exposing the field in different filters. On the other hand Full Frame mode is not recommended for very bright objects because of pixel saturation (see UHB)

4) V Grism or UV Grism observation of a single target: "Science User Defined" Mode

When selecting to observe with a Grism in Science User Defined Mode the IMAGE window is automatically defined for an optimal extraction of the spectrum of a target.

5) V Grism or UV Grism observation of several targets in a field: "Full Frame Low Resolution" Mode

This mode has to be selected if one is interested in the spectra of several targets in a field (note: if the field is crowded it may not be possible to separate the spectra of the different objects).

"FULL FRAME HIGH RESOLUTION" mode is **NOT recommended** because of its inefficiency (very long overhead time). It is also very prone to loose data during downlink. In addition, this type of data can not be reduced with SAS until next SAS release foreseen for early 2006.

XRPS will read the choice of prime instrument made by the user and will offer in the OM modes pull-down menu only those that are compatible with that prime instrument. Thus, the user will see only part of the configurations/modes from Tab. 8 listed in the pull-down menu on the screen. When reconsidering the choice of prime instrument AFTER having specified OM exposure details, one must go back and change these entries in compliance with the newly defined prime instrument. Otherwise the exposures are invalid (XRPS will flag an error condition). The use of non compatible filters and modes would give an error message, for instance V GRISM and UV GRISM filters are not compatible with "EPIC/RGS Image" modes.

"Order (ins. based)" In this field you can define the order of multiple exposures using the same instrument and filter within an observation. This number is calculated automatically if left blank.

Note: If the user does not include OM exposures in the observation then the SOC will consider one of the following approaches: i) to use the available time for OM calibrations, ii) to include OM exposures suited for the particular target, iii) to introduce OM exposures in filters “UVM2”, “UVW1” and “U” in “Full Frame Low Resolution” mode.

5.2.4.6 Filling in OM exposure details in “Science User Defined Mode”

For the OM “Science User Defined” mode a number of details has to be specified on a special page by pressing the “Add Details” button at the bottom of the exposure page. The appropriate formsheet is displayed in Fig. 17.

OM Setting : Proposal 2648, Observation 1, Exposure 1

OM Science Window Details									
Win No.	Mode	X0	Y0	DX	DY	Time Slice	BIN X	BIN Y	Action
1	Image	12 29 06.7	02 03 08.6	2	2	n/a	1	1	Edit Delete
2	Fast	12 29 06.7	02 03 08.6	0.174	0.182	500	n/a		Edit Delete

Add New Window

Window Mode Fast ★

Center Position of Window

(X0) **Right Ascension** 12 H 29 M 06.7 S (J2000) ★

(Y0) **Declination** 02 D 03 M 08.6 S (J2000) ★

Size of Window

(DX) **In Arcmin** 0.174 ★

(DY) **In Arcmin** 0.182 ★

Mandatory input field for Fast Mode settings

Time Slice Duration (ms) 500

Mandatory input field for Image mode settings

DPU Binning in X Direction ▼

DPU Binning in Y Direction ▼

Lower Left Position of Window

In Pixels ★

In Pixels ★

Size of Window

In Pixels ★

In Pixels ★

Commit

Figure 17: Screen shot of an OM exposure details page. Entries for one science window and one FAST window have already been committed to memory; those for a second FAST window are still in the input fields. Committal of this will add a third entry in the upper part of the form. Up to 5 windows can be defined

At the top of the page you see a list of the defined readout windows with their characteristics. In the bottom is the form to define a new window to be added, to be exposed simultaneously.

Add new Window / Editing Win No. x When adding a new readout window (Image or Fast) there are two columns of input fields, only one of which must be filled in. The left column asks for the sky coordinates and the size of the window in angular units. The right column requires inputs in detector coordinates (pixels). It is strongly recommended to define these windows **either in sky coordinates or in pixels, consistently**, not mixing the two types of window definitions. Partial overlapping of windows can lead to completely lose the exposure, and the risk of overlapping them by mistake is higher if some are defined in pixels and others in sky coordinates.

The default coordinates for the centre of a new window are the boresight coordinates defined above at the observation level. The total number of pixels of all user defined windows must not exceed 432 698. The scale for unbinned pixels (BIN=0) is 0.476"/pix. For example, the maximum size (DX,DY) for a single square window is:

for BIN X=0 BIN Y=0: 5.17 x 5.17 arcmin or 652 x 652 pixels

for BIN X=1 BIN Y=1: 7.74 x 7.61 arcmin or 976 x 960 pixels

Upon committal of a set of entries defining a science window, the top part of the web page in Fig. 17 is filled automatically. Up to 5 science windows may be defined in total, of which up to 2 may be operated in the FAST mode. A single FAST window is not allowed, always define at least one IMAGE window.

The boundary conditions that apply to the definition of the science windows are described in the UHB. It may also be of help in the definition of the windows of this mode the OM Tool developed at MSSL:

(http://www.mssl.ucl.ac.uk/www_astro/xmm/om/om.html).

Time Slice Duration (ms) For each FAST mode window the time slice duration (TSD) must be specified, i.e., the length of individual readouts within an exposure. The allowed range is 500–20 000 ms. The recommended TSD is 500 ms.

DPU binning In the lower part of the OM exposure settings page the pixel binning in the Digital Processing Unit (DPU) must be specified for each image mode window. The choice is between values from 0 to 2. They stand for the power of 2. Value 0 represents $2^0 = 1$ pixels, $2^1 = 2$ and $2^2 = 4$. Since only equal binning in both the X and Y directions makes sense, the choice is between binnings of 1×1 , 2×2 and 4×4 original 0.5" (DPU) pixels. Default binning is 2×2 pixels (i.e. bin=1).

More details on the required input for non-standard OM science windows are provided in the appropriate UHB chapter. The correct specification of OM science windows, which are constrained by various observation-dependent parameters, is the user's responsibility. Users proposing observations with non-standard OM science windows should ask for SOC enhancement support. However, note that the available SOC support to help users will be limited.

5.2.4.7 OM grism observations

There are two grisms on the OM filter wheel, named “6-VISIBLE GRISM” and “10-UV GRISM” covering the optical and the UV wavelength range, respectively (see UHB for details). The dispersion direction of both grisms is close to the detector Y-axis (+6 deg for the “UV GRISM” and -6 deg for the “VISIBLE GRISM”). The dispersed first-order spectra of both grisms are centred with their reference wavelength (260 nm and 420 nm, respectively) on the detector location that the target would have with a non-dispersive filter in place. Each grism has a zero- and a first-order image. The spectra of the two grisms differ in size (in both orders). GRISM observations are only compatible with the “Science User Defined Mode” mode with its corresponding default window (about 2’ x 13’ along the dispersion direction), or with a “FULL FRAME” mode (17’ x 17’ field). For a single target or a small region it is recommended the **“Science User Defined” mode** with its default window. The **FULL FRAME LOW RESOLUTION** mode is recommended for several targets in an extended field. In this case if the field is crowded the spectra and zero orders may overlap and it may be difficult its extraction. In both modes if the dispersion direction overlaps with a bright object it may also be problematic for the spectra extraction.

5.3 Formal checks on a proposal

When all entries are made and all proposal pages have been successfully committed to memory, have XRPS go through all observations again to perform a few basic checks (essentially the observation and exposure times), by hitting the “Check Proposal” button.

If all entries are formally correct and no compulsory entries are missing, XRPS will report an “End of check - PASSED” status for each observation individually.

XRPS will calculate the sum of all exposure, overhead and eventual offset (delay between individual exposures) times for each of the **XMM-Newton** instruments per observation and compare this with the observation duration. If the sum is higher than the observation duration, XRPS will raise an error condition. If the sum for the X-ray instruments is lower than 97% of the total observation duration, another error message is issued. In both cases the exposure times have to be corrected. For OM observations only the maximum limit gives an error while exposure times less than 97% of the total observation time just issue a warning message.

An example is displayed in Fig. 18. In this example the check failed and the user is warned that EPIC pn exposure time, including overhead time, exceeds the allowed observation time, and that one of the instruments is using less than 97% of the total observation time available.

In this case the user is asked to correct the appropriate entries. This procedure must be repeated by using the navigation tool in the left-hand frame to go back to the pages and apply the necessary changes until the proposal passes the checks.

For a more detailed check of the proposal’s observational parameters use the “Technical Evaluation” button (see § 5.6).

5.3.1 Hitting the “Check Proposal” button accidentally

In case the “Check Proposal” button is hit accidentally, the recovery procedure is to use the “reload” function of the web browser to go back to the page that had been loaded. It

Check Proposal**Proposal Details Validation****Observation 1****Summary for Observation 1**

Info	Observation 1	Total Observation Duration = 50000 seconds, with 99 repetitions.
-------------	---------------	--

Exposure Summary for Observation 1

Instrument	Sum of Exposures	Sum of Offsets	Sum of Overheads	Total Duration	Difference
EPIC MOS 1	49328	0	672	50000	0
EPIC MOS 2	49500	0	672	50172	172
EPIC pn	45060	0	4940	50000	0
RGS 1	49909	0	91	50000	0
RGS 2	48000	0	91	48091	-1909
OM	45000	0	4917	49917	-83

Validation Report for Observation 1

Error	Observation 1	Total duration of EPIC MOS 2 exposures is greater then Observation Duration	Alter Exposures or Observation
Error	Observation	Total duration of RGS 2 exposures must be at least 97% of the Observation Duration	Alter Exposures or Observation

End of check - FAILED

Figure 18: Screen shot of a proposal that has not passed the formal XRPS check. Below the observation and exposure summaries appear the error reports. In this case the EPIC MOS 2 exposure is exceeding the allowed observation time of 50 000 s by 172 s. On the other hand the RGS 2 exposure is using less than 97% of the total observation time available. In both cases the user has to go back and change the exposure time. This can be done easily following the link at the end of the error report line.

is also possible to click on any entry in the left-hand frame of the navigation tool.

5.4 Modifying a proposal

Please note that **reloading proposals for subsequent editing is only possible from the intermediate memory!** Once a proposal has been submitted to the proposal database, it cannot be retrieved from there again (it will continue to exist in the working memory, however).

5.5 Producing a postscript version of the proposal

At this time (i.e., when all XRPS forms have been filled-in completely and correctly), it is also possible to create a postscript version of the proposal by pressing the “Postscript Version of Proposal” button. This allows users to view/print or download to their home sites a postscript version of the proposal. Doing this serves two purposes:

1. The postscript output provides the user with a control printout for checking inputs once again.

At this point it is still possible to go back to any of the proposal pages to change, add or delete information. The new version of each page must be committed to memory again before proceeding to the next step.

2. The postscript file serves as the author's copy of the proposal. The final postscript version will also be e-mailed together with the acknowledgement of submission back to the PI.

It is not foreseen that the **XMM-Newton** SOC will provide proposers with a printed version of their proposal(s).

Note that this PS version of the proposal will contain only the XRPS forms, not the scientific justification (that the user needs to have as a separate file at his/her home site anyway).

5.6 Technical evaluation of the proposal

Pressing the “Technical Evaluation” button will produce an evaluation report summarizing possible instrument setup problems related to an optimal use of the instruments with respect to the scientific goals and eventual instrument safety issues. This is a preliminary check that should help to spot some of the most evident problems (e.g. pile-up, optical loading, etc.) of a proposal already at this stage.

The “Technical Evaluation” report is generated by pressing the “Technical Evaluation” button and sent to the email address specified in the personal details page of the PI.



Figure 19: *Screen shot of the page generated with the “Technical Evaluation” button.*

Please, complete all forms of the proposal in detail before running the “Technical Evaluation” to avoid a lot of warnings in the “Technical Evaluation” report that were just generated because of missing information.

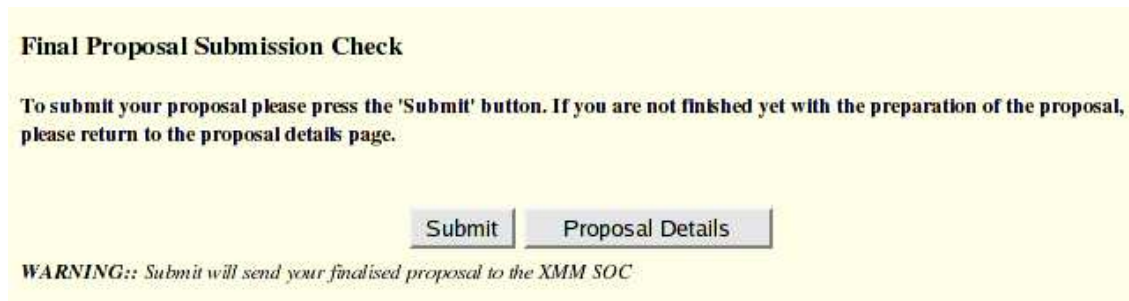
For every problem-type detected in the proposal a short problem description will be produced, together with guidelines as to how to solve the problem. It is also clearly stated there if the suggested changes are “MANDATORY”, in order to not endanger the health of the instruments, or just “SUGGESTIONS” to optimize the data quality of the requested observations.

Although it is possible to submit a proposal containing “Technical Evaluation” problems even of the “MANDATORY” type, the SOC will NOT allow the requested observation to be performed without changes, and will come back to the PI with an alternative solution.

In all other cases it is the ultimate responsibility of the PI to check the impact of the suggested changes on the scientific goal of her/his proposal and to accept or reject the suggestions accordingly. However, during the process of “proposal enhancement” the SOC will propose to the PI an “optimal” instrument setup taking into account the latest calibration results from the instruments.

5.7 Submitting a proposal

To finally submit a proposal it has to be “checked” first pressing the “Check Proposal” button. At the bottom of that page pressing the button “Continue” will lead to the “Final Proposal Submission Check” form (see Fig. 20).



Final Proposal Submission Check

To submit your proposal please press the 'Submit' button. If you are not finished yet with the preparation of the proposal, please return to the proposal details page.

WARNING:: Submit will send your finalised proposal to the XMM SOC

Figure 20: *Final form to submit a proposal*

This is the **last chance** to get back to edit your proposal pressing the “Proposal Details” button. A proposal can be submitted **only once** and will disappear from the working area after pressing “Submit”, so that it will not be possible to edit it again in a new browser session at a later time.

Submission will only be acknowledged by email upon receipt of the submitted proposal in the primary database.

If changes need to be made to the proposal after submission, the PI has to contact the **XMM-Newton** Users Support Group via `xmmpi@sciops.esa.int` to enable the proposal again. This email must list the proposal number in the Subject line.

Note: Successful submission does not imply that all details of the proposal are formally correct or complete, because the formal checks performed by XRPS are not complete.

6 Acknowledgement of receipt

Upon successful submission of a proposal to the database, users will be notified via email (at peak times this might take a while). This email will contain the proposal number, title and as an attachment the postscript version of the submitted proposal.

Users who do not receive an email within 24 hours after submitting a proposal should

- verify that there is no typo in the email address that was entered into XRPS and
- then try to verify that the mail server at your home institution was up and running.

If neither of these indicates a problem, please get in touch with the SOC via the **XMM-Newton** Helpdesk, using the subject “Missing proposal submission verification”, flagging the email as “private” and identifying your proposal by PI name and full title.

7 SOC enhancement requests

XMM-Newton SOC user support will be provided by a small team of support astronomers. Therefore SOC enhancement requests and all other manual interactions with the proposal database must be limited to a minimum.

8 Submitting ToO requests

Requests to observe a Target of Opportunity (ToO) are not submitted via XRPS, because the software will be taken offline after the deadline of AO-6. The process of ToO submission is described in the Policies and Procedures document and this route should be followed in all cases.

9 XRPS performance

Following some problems encountered with XRPS performance during the heaviest-load period of the **XMM-Newton** AO-2 proposal submission exercise in October 2001, the **XMM-Newton** Remote Proposal Submission System and strategy have both been dramatically revised. Network and firewall approaches have been adapted, hardware performance has been enhanced, and extensive efficiencies have been achieved in software implementation. The adoption of a two-phase proposal submission strategy ensures that during the AO-6 Phase II Proposal Data Entry cycle, the full capabilities of the revised XRPS system will be focussed on those users whose successful proposals have been awarded AO-6 observing time by OTAC.

For these reasons we are confident that problems such as those encountered at the single deadline of the AO-2 Proposal Submission exercise will play no part in the staggered AO-6 Phase II Proposal Data Entry cycle.

That said, it is only common sense and friendly advice to allow that our users will enjoy the benefits of a more responsive system and data entry environment if they avoid leaving

the job until the last moment! So we encourage PIs to benefit from the full extent of the time windows that have been made available for proposal data entry.

10 Related documents, tools and online services

Related documents, tools and other **XMM-Newton** online services can be found at the following addresses:

1. XRPS online
<http://xmmrps.esac.esa.int/>
2. This document (XRPS Users' Manual)
http://xmm.esac.esa.int/external/xmm_user_support/documentation/rpsman/index.html
3. **XMM-Newton** Users' Handbook
http://xmm.esac.esa.int/external/xmm_user_support/documentation/uhb/index.html
4. AO-6 documents
http://xmm.esac.esa.int/external/xmm_science/A06/index.shtml
5. Policies and Procedures
<ftp://xmm.esac.esa.int/pub/A06/A06PoliciesProcedures.pdf>
6. **XMM-Newton** Target Visibility Tool
http://xmm.esac.esa.int/external/xmm_sched/vischeck/vischeck.shtml
7. The **XMM-Newton** Science Simulator (SciSim)
<http://xmm.esac.esa.int/scisim/scisim.html>
8. PIMMS (HEASARC)
<http://heasarc.gsfc.nasa.gov/Tools/w3pimms.html>
9. **XMM-Newton** Helpdesk
http://xmm.esac.esa.int/external/xmm_user_support/helpdesk.shtml
10. **XMM-Newton** Latest News
http://xmm.esac.esa.int/external/xmm_news/latest_news.shtml

Additional information on **XMM-Newton** can always be obtained from other locations under the SOC home page, at the URL <http://xmm.esac.esa.int/>.

A Observation examples

In this chapter we provide a few examples for **XMM-Newton** observations of selected generic target categories. The crucial entries that must be made in XRPS are listed. The examples follow the instructions presented above for planning **XMM-Newton** observations (§ 3.1).

A.1 Observation of a faint extended source

As an example for a faint extended X-ray source one might consider observing a cluster of galaxies, at relatively low redshift, z . Input of standard information (target name, catalogued position etc.) in XRPS is trivial. Other input parameters require some more thought:

Choice of prime instrument Chose the **XMM-Newton** prime instrument according to your main scientific goal. If moderate resolution spectroscopy is most important for the proposed science, the observer might want to select the EPIC pn camera. Alternatively, if high-resolution spectroscopy is intended, (s)he may want to chose the RGS instrument.

Science mode of the prime instrument If the source is weak, all EPIC cameras can be assumed to have no problems with photon pile-up. In that case, they can all be used in the standard FULL FRAME imaging mode. RGS could be used in its standard SPECTROSCOPY mode.

X-ray properties of the source Based on PIMMS observers can convert *ROSAT*, *ASCA* or other known flux and band data into the **XMM-Newton** band (0.1–15 keV), and enter these, together with an X-ray spectral model, e.g. Raymond-Smith, $kT = 6$ keV, $N(H) = 3e20 \text{ cm}^{-2}$ and the lower and upper limit of the energy band over which the X-ray flux was observed into XRPS.

Length of observation vs. visibility constraints Users must check that the requested observation fits into a continuous visibility period of the **XMM-Newton** orbit, using the **XMM-Newton** Target Visibility Tool. In case the required total integration time is longer than the longest possible visibility window, the observation must be split into an adequate number of individual observations.

Pointing coordinates Assuming that the cooling flow is located at the core of the cluster, no boresight coordinates need to be entered and thus the target coordinates will automatically be propagated into the boresight fields. Otherwise, the boresight would be chosen to be directed towards the location of the brightest/most important X-ray feature to be observed. The best data quality will be achieved in the aim point of the prime instrument.

Avoidance of nearby bright sources Optical and X-ray catalogues should be searched for nearby bright sources which might lead to contamination of either the X-ray (e.g., RGS spectral overlaps) and/or optical/UV observations. Such sources

must be avoided, which might require a Position Angle (PA) constraint. Such constraints can be calculated using the Science Simulator (Scisim).

Science modes of the other instruments The expected RGS count rates are lower than those for EPIC. There will thus be no need for fast readouts and RGS would be used in its standard SPECTROSCOPY mode.

Assuming that the cluster fits into the OM's 17' FOV, the standard configuration would be chosen ("EPIC IMG" or "RGS IMG").

EPIC filters Since the source is assumed to be weak (both in X-rays and the optical/UV) the "THIN" optical blocking filter can be used.

RGS readout sequence In case of standard spectroscopy observations there is no need to change anything in the RGS readout sequence. CCDs will then be read out sequentially.

OM brightness limit Before planning details of OM observations, users should check for the presence of bright optical/UV sources within the OM's FOV. There should be no source in the FOV that violates the brightness constraints tabulated in UHB Table 23. If such sources exist, no OM exposure should be included.

OM filters and modes have to be chosen according to the optical characteristics of the target (see 5.2.4.5).

Length of exposures All X-ray observations of faint sources can be obtained in a single exposure covering the entire duration of the observation.

The OM exposure times should be chosen according to the explanations in § 5.2.4.5 and the OM chapter of the UHB.

A.2 Observation of a bright extended source

Consider as an example for a bright extended X-ray source a relatively compact supernova remnant (SNR). Input of standard information (target name, catalogued position etc.) in XRPS is trivial. Other input parameters require some more thought:

Choice of prime instrument There might be a bright emission knot near the desired field centre. If moderate resolution spectroscopy is most important for the proposed science, the observer might want to select the EPIC pn camera. Alternatively, if high-resolution spectroscopy is intended, (s)he may want to chose the RGS instruments (which is the unit with the highest energy resolution). Let us, for the time being, assume that RGS is prime.

Science mode of the prime instrument RGS can probably be used in its standard SPECTROSCOPY mode. In case of doubt, i.e., if the source has prominent emission lines, SciSim should be used to model the spectrum and check for potential pile-up problems.

X-ray properties of the source Based on PIMMS observers can convert *ROSAT*, *ASCA* or other known flux and band data (if known), and enter these, together with an X-ray spectral model, e.g. thermal bremsstrahlung, $kT = 5$ keV, $N(H) = 1e20 \text{ cm}^{-2}$ and the lower and upper limit of the energy band over which the X-ray flux was observed.

Length of observation vs. visibility constraints Users must check that the requested observation fits into a continuous visibility period of the **XMM-Newton** orbit, using the **XMM-Newton** Target Visibility Tool. In case the required total integration time is longer than the longest possible visibility window, the observation must be split into an adequate number of individual observations.

Pointing coordinates Assuming that the bright knot is not located at the centre of the SNR, its coordinates must be entered into the boresight fields. This is the position on which the prime instrument will be centred. The best data quality will be achieved in the aim point of the prime instrument.

Avoidance of nearby bright sources Optical and X-ray catalogues should be searched for nearby bright sources which might lead to contamination of either the X-ray (e.g., RGS spectral overlaps) and/or optical/UV observations. Such sources must be avoided, which might lead to a position angle constraint.

Science modes of the other instruments The science modes of the instruments will mostly be determined by the level of photon pile-up to be expected. As mentioned above (in § 5.2.3), EPIC pile-up calculations should be based on the brightest emission region's count rate. In the case of a bright knot in a known SNR, this could be done by estimating from (for example) *ROSAT* images the brightness within one **XMM-Newton** Point-Spread Function (PSF; see UHB section on **XMM-Newton** X-ray PSF). For the PSF a Full Width at Half Maximum (FWHM) of $6''$ can be assumed.

For the pn camera we compare the merits of two modes: Full Frame Mode could be used if the pile-up constraints are acceptable for the science goals. Large Window Mode can be used for sources up to $15'$ extent, and where exterior to this range there are no bright regions that would affect the desired image.

For MOS we compare the merits of two modes as well: Full Frame Mode could be used if the pile-up constraints are acceptable for science goals. The Large Window (300×300 pixels) can be used for sources up to $6'$ extent.

The expected RGS count rates are lower than those for EPIC. Therefore, RGS can in most cases be operated in its SPECTROSCOPY mode.

If no high time resolution is required for the OM observations, an imaging mode default configuration should be chosen (in this case, since RGS is prime instrument, RGS IMG). The optical surface brightness of the brightest region of the target must be compared with the OM brightness limits (UHB Table 23).

EPIC filters Using the instructions provided in the UHB on EPIC filters, the user must decide which optical blocking filter suppresses optical loading in the soft part of the X-ray passband sufficiently and at the same time has minimal impact on the proposed science.

RGS readout sequence In case of standard spectroscopy observations there is no need to change anything in the RGS readout sequence. The CCDs will then be read out sequentially. However, there might be strong emission lines, which the user wants to read out faster than the rest of the spectrum. One way of doing this would be to use the RGS SPECTROSCOPY mode and a readout sequence of e.g. [3 1 2 3 4 5 3 6 3 8 9], in which CCD #3 of RGS-1 is read out 4 times more often than all others (assuming that the bright line would be registered on chip 3; see the UHB section on RFC arrays).

OM brightness limit Before planning details of OM observations, users should check for the presence of bright optical/UV sources within the OM's FOV. There should be no source in the FOV that violates the brightness constraints tabulated in UHB Table 23. If such sources exist, no OM exposure should be included.

OM filters and modes have to be chosen according to the optical characteristics of the target (see 5.2.4.5).

Length of exposures The OM exposure times should be chosen according to the explanations in § 5.2.4.5 and the OM chapter of the UHB. For the OM imaging mode each exposure must have a length of 800–5000 s.

A.3 Imaging observation of a point source

Users might be interested in observing a bright point source (like, e.g., an unresolved AGN, binary or stellar object). Input of standard information (target name, catalogued position etc.) in XRPS is trivial. Other input parameters require some more thought:

Choice of prime instrument The prime instrument is chosen according to the importance of data from either type of **XMM-Newton** instrument: either EPIC pn, if imaging with moderate resolution spectroscopy is crucial, or RGS, if the highest possible spectral resolution must be achieved. Let us, for the time being, assume that RGS is prime.

Science mode of the prime instrument Depending on the required science data (either standard spectroscopy or high time-resolution spectro-photometry), RGS can be operated either in its standard SPECTROSCOPY or the HIGH COUNT RATE (HCR) mode. In case SPECTROSCOPY is used and if the source has prominent emission lines, SciSim modeling of the spectrum should be performed to check for potential pile-up problems.

X-ray properties of the source Based on PIMMS observers can convert *ROSAT*, *ASCA* or other known flux and band data (if known), and enter these, together with an X-ray spectral model, e.g. power law, $\Gamma = 0.7$, $N(\text{H}) = 3\text{e}21 \text{ cm}^{-2}$ and the lower and upper limit of the energy band over which the X-ray flux was observed.

Length of observation vs. visibility constraints Users must check that the requested observation fits into a continuous visibility period of the **XMM-Newton** orbit, using the **XMM-Newton** Target Visibility Tool. In case the required

total integration time is longer than the longest possible visibility window, the observation must be split into an adequate number of individual observations.

Pointing coordinates No boresight coordinates need be entered to centre the target on the prime instrument, because the target coordinates will be propagated automatically into the boresight fields, if no other values are provided. The best data quality will be achieved in the aim point of the prime instrument.

Avoidance of nearby bright sources Optical and X-ray catalogues should be searched for nearby bright sources which might lead to contamination of either the X-ray (e.g., RGS spectral overlaps) and/or optical/UV observations. Such sources must be avoided, which might lead to a position angle constraint.

Science modes of the other instruments The science modes of the instruments will mostly be determined by the level of photon pile-up to be expected, as mentioned above (in § 5.2.3).

For the pn camera we decide that the Small Window Mode is necessary to accommodate the source brightness without pile-up degradation (using the information provided in the UHB section on EPIC modes). This mode offers a total of 4' field coverage. We note the effect of significant dead time, which must be taken into account to obtain the correct exposure time (PIMMS and the plots provided in the UHB account for this).

For MOS we compare the merits of two modes: Small Window Mode (100×100 pixels) is able to accommodate the point source spatially. If the mode is not able to accommodate the expected flux without significant pile-up, then the Timing Mode must be considered.

If no high time resolution is required for the OM observations, an imaging mode default configuration should be chosen (in this case, since RGS is prime instrument, RGS IMG). For parallel fast mode optical/UV monitoring, the RGS IMG FST default configuration should be chosen. Because of the small size of the window it is very important to get the coordinates right.

EPIC filters Using the instructions provided in the UHB on EPIC filters, the user must decide which optical blocking filter suppresses optical loading in the soft part of the X-ray passband sufficiently and at the same time has minimal impact on the proposed science.

RGS readout sequence In case of standard spectroscopy observations there is no need to change anything in the RGS readout sequence. CCDs will then be read out sequentially. However, there might be strong emission lines that the user wants read out faster than the rest of the spectrum. One way of doing this would be to use the RGS SPECTROSCOPY mode and a readout sequence of e.g. [3 1 2 3 4 5 3 6 3 8 9], in which CCD #3 of RGS-1 is read out 4 times more often than all others (assuming that the bright line would be registered on chip #3; see the UHB section on RFC arrays). If the mode is not able to accommodate the expected flux without significant pile-up, then the HIGH COUNT RATE (HCR) must be considered.

OM brightness limit Before planning details of OM observations, users should check for the presence of bright optical/UV sources within the OM's FOV. There should

be no source in the FOV that violates the brightness constraints tabulated in UHB Table 23. If such sources should exist, no OM exposure should be included.

OM filters and modes have to be chosen according to the optical characteristics of the target (see 5.2.4.5).

Length of exposures Normally, the X-ray observations can be obtained in a single exposure covering the entire duration of the observation.

The OM exposure times should be chosen according to the explanations in § 5.2.4.5 and the OM chapter of the UHB.

A.4 Timing observation of a variable source

Consider observing a bright point source, as above (like, e.g., an unresolved AGN, binary or stellar object), but now with a special interest in high time resolution measurements. Input of standard information (target name, catalogued position etc.) in XRPS is trivial. Other input parameters require some more thought:

Choice of prime instrument The prime instrument is chosen according to the importance of data from either type of **XMM-Newton** instrument: either EPIC, if imaging with moderate resolution spectroscopy is crucial, or RGS, if the highest possible spectral resolution must be achieved. Let us, for the time being, assume that EPIC is prime.

Science mode of the prime instrument For high time-resolution observations the EPIC pn TIMING mode is a suitable choice.

X-ray properties of the source Based on PIMMS observers can convert *ROSAT*, *ASCA* or other known flux and band data (if known), and enter these, together with an X-ray spectral model, e.g. power law, $\Gamma = 0.7$, $N(\text{H}) = 3\text{e}21 \text{ cm}^{-2}$ and the lower and upper limit of the energy band over which the X-ray flux was observed.

Length of observation vs. visibility constraints Users must check that the requested observation fits into a continuous visibility period of the **XMM-Newton** orbit, using the **XMM-Newton** Target Visibility Tool. In case the required total integration time is longer than the longest possible visibility window, the observation must be split into an adequate number of individual observations.

Pointing coordinates No boresight coordinates need be entered to centre the target on the prime instrument, because the target coordinates will be propagated automatically into the boresight fields, if no other values are provided. The best data quality will be achieved in the aim point of the prime instrument.

Science modes of the other instruments Based on the nature of the example, one can assume that all instruments will be operated in their fast modes. EPIC pn reaches a time resolution of 0.03 ms in its TIMING mode, MOS reaches

a resolution of 1.5 ms. Note that the pn camera in its Small Window mode already reaches a time resolution of 6 ms, which would at the same time render possible imaging of the target. RGS would be operated in the HIGH COUNT RATE (HCR) mode and OM in the fast mode default configuration EPIC IMG FST.

Avoidance of nearby bright sources Optical and X-ray catalogues should be searched for nearby bright sources which might lead to contamination of either the X-ray (e.g., RGS spectral overlaps) and/or optical/UV observations. In particular when the EPIC TIMING mode and also the RGS HIGH COUNT RATE (HCR) mode is used, one must ensure that nearby sources do not contaminate the target data. There must be no nearby source in the same column of the EPIC cameras as the science target. However, note that the two MOS cameras are mounted orthogonally to each other. For the RGS there must be no source along the dispersion direction of the target spectrum. Such sources must be avoided, which might lead to a position angle constraint.

EPIC filters Using the instructions provided in the UHB on EPIC filters, the user must decide which optical blocking filter suppresses optical loading in the soft part of the X-ray passband sufficiently and at the same time has minimal impact on the proposed science.

RGS readout sequence The user must determine whether one single CCD (if yes, which one) or all eight RGS CCDs shall be read out. The whole spectral range (all 8 CCDs) can be read out in about 150 ms.

OM brightness limit Before planning details of OM observations, users should check for the presence of bright optical/UV sources within the OM's FOV. There should be no source in the FOV that violates the brightness constraints tabulated in UHB Table 23. If such source should exist, no OM exposure should be included.

OM filters and modes have to be chosen according to the optical characteristics of the target (see 5.2.4.5).

Length of exposures Normally, X-ray observations can be obtained in a single exposure covering the entire duration of the observation.

The OM exposure times should be chosen according to the explanations in § 5.2.4.5 and the OM chapter of the UHB.